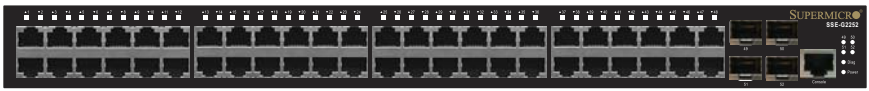
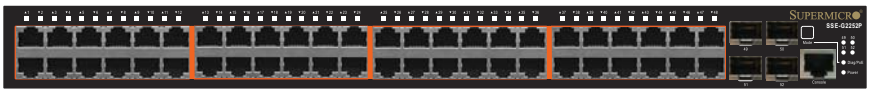
SSE-G2252 Switches

52-Port Layer 2 Gigabit Ethernet Switch



SSE-G2252P Switches

52-Port Layer 2 Gigabit Ethernet Switch with
48 PoE-Capable Ports



USER'S MANUAL

Revison 1.0

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Manual Revison 1.0

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Preface

About this Manual

This manual is written for professional system integrators, Information Technology professionals, service personnel, technicians and network administrators who are responsible for installing and setting up network equipment; consequently, it assumes a basic working knowledge of LANs (Local Area Networks). It provides information for the installation and use of Supermicro's SSE-G2252 and SSE-G2252P switches. Installation and maintenance should be performed by experienced professionals only.

Glossary

Glossary Term	Description
ACL	Access Control List. ACLs can limit network traffic and restrict access to certain users or devices by checking each packet for certain IP or MAC (i.e., Layer 2) information.
ARP	Address Resolution Protocol converts between IP addresses and MAC (hardware) addresses. ARP is used to locate the MAC address corresponding to a given IP address. This allows the switch to use IP addresses for routing decisions and the corresponding MAC addresses to forward packets from one hop to the next.
BOOTP	Boot Protocol. BOOTP iS used to provide bootup information for network devices, including IP address information, the address of the TFTP server that contains the devices system files, and the name of the boot file.
CoS	Class of Service is supported by prioritizing packets based on the required level of service, and then placing them in the appropriate output queue. Data is transmitted from the queues using weighted round-robin service to enforce priority service and prevent blockage of lower-level queues. Priority may be set according to the port default, the packet's priority bit (in the VLAN tag), TCP/UDP port number, IP Precedence bit, or DSCP priority bit.
DHCP	Dynamic Host Control Protocol. Provides a framework for passing configuration information to hosts on a TCP/IP network. DHCP is based on the Bootstrap Protocol (BOOTP), adding the capability of automatic allocation of reusable network addresses and additional configuration options.
DHCP Snooping	A technique used to enhance network security by snooping on DHCP server messages to track the physical location of hosts, ensure that hosts only use the IP addresses assigned to them, and ensure that only authorized DHCP servers are accessible.

Glossary Term	Description
DiffServ	Differentiated Services provides quality of service on large networks by employing a well-defined set of building blocks from which a variety of aggregate forwarding behaviors may be built. Each packet carries information (DS byte) used by each hop to give it a particular forwarding treatment, or per-hop behavior, at each network node. DiffServ allocates different levels of service to users on the network with mechanisms such as traffic meters, shapers/droppers, packet markers at the boundaries of the network.
DNS	Domain Name Service. A system used for translating host names for network nodes into IP addresses.
DSCP	Differentiated Services Code Point Service. DSCP uses a six-bit tag to provide for up to 64 different forwarding behaviors. Based on network policies, different kinds of traffic can be marked for different kinds of forwarding. The DSCP bits are mapped to the Class of Service categories, and then into the output queues.
EAPOL	Extensible Authentication Protocol over LAN. EAPOL is a client authentication protocol used by this switch to verify the network access rights for any device that is plugged into the switch. A user name and password is requested by the switch, and then passed to an authentication server (e.g., RADIUS) for verification. EAPOL is implemented as part of the IEEE 802.1X Port Authentication standard.
EUI	Extended Universal Identifier is an address format used by IPv6 to identify the host portion of the network address. The interface identifier in EUI compatible addresses is based on the link-layer (MAC) address of an interface. Interface identifiers used in global unicast and other IPv6 address types are 64 bits long and may be constructed in the EUI-64 format. The modified EUI-64 format interface ID is derived from a 48-bit link-layer address by inserting the hexadecimal number FFFE between the upper three bytes (OUI field) and the lower 3 bytes (serial number) of the link layer address. To ensure that the chosen address is from a unique Ethernet MAC address, the 7th bit in the high-order byte is set to 1 (equivalent to the IEEE Global/Local bit) to indicate the uniqueness of the 48-bit address.
GARP	Generic Attribute Registration Protocol. GARP is a protocol that can be used by endstations and switches to register and propagate multicast group membership information in a switched environment so that multicast data frames are propagated only to those parts of a switched LAN containing registered endstations. Formerly called Group Address Registration Protocol.
GMRP	Generic Multicast Registration Protocol. GMRP allows network devices to register end stations with multicast groups. GMRP requires that any participating network devices or end stations comply with the IEEE 802.1p standard.
GVRP	GARP VLAN Registration Protocol. Defines a way for switches to exchange VLAN information in order to register necessary VLAN members on ports along the Spanning Tree so that VLANs defined in each switch can work automatically over a Spanning Tree network.
IEEE 802.1D	Specifies a general method for the operation of MAC bridges, including the Spanning Tree Protocol.

Glossary Term	Description
IEEE 802.1Q	VLAN Tagging—Defines Ethernet frame tags which carry VLAN information. It allows switches to assign endstations to different virtual LANs, and defines a standard way for VLANs to communicate across switched networks.
IEEE 802.1p	An IEEE standard for providing quality of service (QoS) in Ethernet networks. The standard uses packet tags that define up to eight traffic classes and allows switches to transmit packets based on the tagged priority value.
IEEE 802.1s	An IEEE standard for the Multiple Spanning Tree Protocol (MSTP) which provides independent spanning trees for VLAN groups.
IEEE 802.1w	An IEEE standard for the Rapid Spanning Tree Protocol (RSTP) which reduces the convergence time for network topology changes to about 10% of that required by the older IEEE 802.1D STP standard. (Now incorporated in IEEE 802.1D-2004)
IEEE 802.1X	Port Authentication controls access to the switch ports by requiring users to first enter a user ID and password for authentication.
IEEE 802.3ac	Defines frame extensions for VLAN tagging.
IEEE 802.3x	Defines Ethernet frame start/stop requests and timers used for flow control on full-duplex links. (Now incorporated in IEEE 802.3-2002)
IGMP	Internet Group Management Protocol. A protocol through which hosts can register with their local router for multicast services. If there is more than one multicast switch/router on a given subnetwork, one of the devices is made the “querier” and assumes responsibility for keeping track of group membership.
IGMP Query	On each subnetwork, one IGMP-capable device will act as the querier — that is, the device that asks all hosts to report on the IP multicast groups they wish to join or to which they already belong. The elected querier will be the device with the lowest IP address in the subnetwork.
IGMP Proxy	Proxies multicast group membership information onto the upstream interface based on IGMP messages monitored on downstream interfaces, and forwards multicast traffic based on that information. There is no need for multicast routing protocols in an simple tree that uses IGMP Proxy.
IGMP Snooping	Listening to IGMP Query and IGMP Report packets transferred between IP Multicast Routers and IP Multicast host groups to identify IP Multicast group members.
In-Band Management	Management of the network from a station attached directly to the network.
IP Multicast Filtering	A process whereby this switch can pass multicast traffic along to participating hosts.
IP Precedence	The Type of Service (ToS) octet in the IPv4 header includes three precedence bits defining eight different priority levels ranging from highest priority for network control packets to lowest priority for routine traffic. The eight values are mapped one-to-one to the Class of Service categories by default, but may be configured differently to suit the requirements for specific network applications.
LACP	Link Aggregation Control Protocol. Allows ports to automatically negotiate a trunked link with LACP-configured ports on another device.
Layer 2	Data Link layer in the ISO 7-Layer Data Communications Protocol. This is related directly to the hardware interface for network devices and passes on traffic based on MAC addresses.

Glossary Term	Description
Link Aggregation	See Port Trunk.
LLDP	Link Layer Discovery Protocol is used to discover basic information about neighboring devices in the local broadcast domain by using periodic broadcasts to advertise information such as device identification, capabilities and configuration settings.
MD5	MD5 Message-Digest is an algorithm that is used to create digital signatures. It is intended for use with 32 bit machines and is safer than the MD4 algorithm, which has been broken. MD5 is a one-way hash function, meaning that it takes a message and converts it into a fixed string of digits, also called a message digest.
MIB	Management Information Base. An acronym for Management Information Base. It is a set of database objects that contains information about a specific device.
MSTP	Multiple Spanning Tree Protocol can provide an independent spanning tree for different VLANs. It simplifies network management, provides for even faster convergence than RSTP by limiting the size of each region, and prevents VLAN members from being segmented from the rest of the group.
MRD	Multicast Router Discovery is a A protocol used by IGMP snooping and multicast routing devices to discover which interfaces are attached to multicast routers. This process allows IGMP-enabled devices to determine where to send multicast source and group membership messages.
Multicast Switching	A process whereby the switch filters incoming multicast frames for services for which no attached host has registered, or forwards them to all ports contained within the designated multicast VLAN group.
MVR	Multicast VLAN Registration is a method of using a single network-wide multicast VLAN to transmit common services, such as such as television channels or video-on-demand, across a service-provider's network. MVR simplifies the configuration of multicast services by using a common VLAN for distribution, while still preserving security and data isolation for subscribers residing in both the MVR VLAN and other standard or private VLAN groups.
NTP	Network Time Protocol provides the mechanisms to synchronize time across the network. The time servers operate in a hierarchical-master-slave configuration in order to synchronize local clocks within the subnet and to national time standards via wire or radio.
Out-of-Band Management	Management of the network from a station not attached to the network.
Port Authentication	See IEEE 802.1X.
Port Mirroring	A method whereby data on a target port is mirrored to a monitor port for troubleshooting with a logic analyzer or RMON probe. This allows data on the target port to be studied unobstructively.
Port Trunk	Defines a network link aggregation and trunking method which specifies how to create a single high-speed logical link that combines several lower-speed physical links. Private VLANs Private VLANs provide port-based security and isolation between ports within the assigned VLAN. Data traffic on downlink ports can only be forwarded to, and from, uplink ports.

Glossary Term	Description
QinQ	QinQ tunneling is designed for service providers carrying traffic for multiple customers across their networks. It is used to maintain customer-specific VLAN and Layer 2 protocol configurations even when different customers use the same internal VLAN IDs.
QoS	Quality of Service. QoS refers to the capability of a network to provide better service to selected traffic flows using features such as data prioritization, queuing, congestion avoidance and traffic shaping. These features effectively provide preferential treatment to specific flows either by raising the priority of one flow or limiting the priority of another flow.
RADIUS	Remote Authentication Dial-in User Service. RADIUS is a logon authentication protocol that uses software running on a central server to control access to RADIUS-compliant devices on the network.
RMON	Remote Monitoring. RMON provides comprehensive network monitoring capabilities. It eliminates the polling required in standard SNMP, and can set alarms on a variety of traffic conditions, including specific error types.
RSTP	Rapid Spanning Tree Protocol. RSTP reduces the convergence time for network topology changes to about 10% of that required by the older IEEE 802.1D STP standard.
SMTP	Simple Mail Transfer Protocol is a standard host-to-host mail transport protocol that operates over TCP, port 25.
SNMP	Simple Network Management Protocol. The application protocol in the Internet suite of protocols which offers network management services.
SNTP	Simple Network Time Protocol allows a device to set its internal clock based on periodic updates from a Network Time Protocol (NTP) server. Updates can be requested from a specific NTP server, or can be received via broadcasts sent by NTP servers.
SSH	Secure Shell is a secure replacement for remote access functions, including Telnet. SSH can authenticate users with a cryptographic key, and encrypt data connections between management clients and the switch.
STA	Spanning Tree Algorithm is a technology that checks your network for any loops. A loop can often occur in complicated or backup linked network systems. Spanning Tree detects and directs data along the shortest available path, maximizing the performance and efficiency of the network.
TACACS+	Terminal Access Controller Access Control System Plus. TACACS+ is a logon authentication protocol that uses software running on a central server to control access to TACACS-compliant devices on the network.
TCP/IP	Transmission Control Protocol/Internet Protocol. Protocol suite that includes TCP as the primary transport protocol, and IP as the network layer protocol.
Telnet	Defines a remote communication facility for interfacing to a terminal device over TCP/IP.
TFTP	Trivial File Transfer Protocol. A TCP/IP protocol commonly used for software downloads.
UDP	User Datagram Protocol. UDP provides a datagram mode for packet-switched communications. It uses IP as the underlying transport mechanism to provide access to IP-like services. UDP packets are delivered just like IP packets – connection-less datagrams that may be discarded before reaching their targets. UDP is useful when TCP would be too complex, too slow, or just unnecessary.

Glossary Term	Description
UTC	Universal Time Coordinate. UTC is a time scale that couples Greenwich Mean Time (based solely on the Earth's rotation rate) with highly accurate atomic time. The UTC does not have daylight saving time.
VLAN	Virtual LAN. A Virtual LAN is a collection of network nodes that share the same collision domain regardless of their physical location or connection point in the network. A VLAN serves as a logical workgroup with no physical barriers, and allows users to share information and resources as though located on the same LAN.
XModem	A protocol used to transfer files between devices. Data is grouped in 128-byte blocks and error-corrected.

Table of Contents

Chapter 1 Introduction 1-1
- 1-1 Key Features 1-1
- 1-2 Description of Software Features 1-2
  - Configuration Backup and Restore 1-2
  - Authentication 1-3
  - Access Control Lists 1-3
  - Port Configuration 1-3
  - Port Mirroring 1-3
  - Port Trunking 1-3
  - Rate Limiting 1-4
  - Storm Control 1-4
  - Static Addresses 1-4
  - IEEE 802.1D Bridge 1-4
  - Store-and-Forward Switching 1-4
  - Spanning Tree Algorithm 1-4
  - Virtual LANs 1-5
  - Traffic Prioritization 1-6
  - Quality of Service 1-6
  - Multicast Filtering 1-6
  - System Defaults 1-6

Chapter 2 System Safety 2-1
- 2-1 Electrical Safety Precautions 2-1
- 2-2 General Safety Precautions 2-2
- 2-3 Electrostatic Discharge Precautions 2-2
- 2-4 Operating Precautions 2-3
- 2-5 Compliances and Safety 2-3
  - FCC Class A 2-3
  - Industry Canada - Class A 2-3
  - CE Mark Declaration of Conformance for EMI and Safety (EEC) 2-4
  - Safety Compliance 2-5
  - Power Cord Safety 2-5
  - France and Peru only 2-6
- 2-6 Warnings and Cautionary Messages 2-9
  - Environmental Statements 2-9
  - End of Product Life Span 2-10

Manufacturing Materials 2-10
Chapter 3 Initial Configuration 3-1
3-1 Connecting to the Switch 3-1
Configuration Options 3-1
Required Connections 3-2
Remote Connections 3-3
3-2 Basic Configuration 3-4
Console Connection 3-4
Setting Passwords 3-4
Setting an IP Address 3-5
Manual Configuration 3-5
Dynamic Configuration 3-8
Downloading a Configuration File Referenced by a DHCP Server 3-10
Enabling SNMP Management Access 3-12
Community Strings (for SNMP version 1 and 2c Clients) 3-13
Trap Receivers 3-13
Configuring Access for SNMP Version 3 Clients 3-14
3-3 Managing System Files 3-14
Saving or Restoring Configuration Settings 3-15
Chapter 4 Using the Web Interface 4-1
4-1 Connecting to the Web Interface 4-1
4-2 Navigating the Web Browser Interface 4-2
Home Page 4-2
Configuration Options 4-3
Panel Display 4-4
Showing Status Information 4-4
Main Menu 4-5
Chapter 5 Basic Management Tasks 5-1
5-1 Displaying System Information 5-1
5-2 Displaying Switch Hardware/Software Versions 5-2
5-3 Configuring Support for Jumbo Frames 5-3
5-4 Displaying Bridge Extension Capabilities 5-4
5-5 Managing System Files 5-6
Copying Files via FTP/TFTP or HTTP 5-6
Saving the Running Configuration to a Local File 5-8
Setting The Start-Up File 5-9
Showing System Files 5-10

Automatic Operation Code Upgrade 5-11
5-6 Setting the System Clock 5-15
Setting the Time Manually 5-15
Setting the SNTP Polling Interval 5-16
Specifying SNTP Time Servers 5-17
Setting the Time Zone 5-18
5-7 Configuring the Console Port 5-19
5-8 Configuring Telnet Settings 5-21
5-9 Displaying CPU Utilization 5-22
5-10 Displaying Memory Utilization 5-23
5-11 Resetting the System 5-24
Chapter 6 Interface Configuration 6-1
6-1 Port Configuration 6-1
Configuring by Port List 6-1
Configuring by Port Range 6-4
Displaying Connection Status 6-6
Configuring Local Port Mirroring 6-7
Configuring Remote Port Mirroring 6-9
Showing Port or Trunk Statistics 6-13
Performing Cable Diagnostics 6-18
6-2 Trunk Configuration 6-19
Configuring a Static Trunk 6-20
Configuring a Dynamic Trunk 6-23
Displaying LACP Port Counters 6-28
Displaying LACP Settings and Status for the Local Side 6-29
Displaying LACP Settings and Status for the Remote Side 6-31
Configuring Trunk Mirroring 6-32
6-3 Saving Power 6-34
6-4 Traffic Segmentation 6-36
Enabling Traffic Segmentation 6-36
Configuring Uplink and Downlink Ports 6-37
6-5 VLAN Trunking 6-38
Chapter 7 VLAN Configuration 7-1
7-1 IEEE 802.1Q VLANs 7-1
Assigning Ports to VLANs 7-2
VLAN Classification 7-2
Port Overlapping 7-3

Untagged VLANs 7-3
Automatic VLAN Registration 7-3
Forwarding Tagged/Untagged Frames 7-4
Configuring VLAN Groups 7-4
Adding Static Members to VLANs 7-6
Configuring Dynamic VLAN Registration 7-10
7-2 IEEE 802.1Q Tunneling 7-13
Enabling QinQ Tunneling on the Switch 7-17
Adding an Interface to a QinQ Tunnel 7-18
7-3 Protocol VLANs 7-19
Configuring Protocol VLAN Groups 7-20
Mapping Protocol Groups to Interfaces 7-21
7-4 Configuring IP Subnet VLANs 7-23
7-5 Configuring MAC-based VLANs 7-25
7-6 Configuring VLAN Mirroring 7-27
Chapter 8 Address Table Settings 8-1
8-1 Setting Static Addresses 8-1
8-2 Changing the Aging Time 8-3
8-3 Displaying the Dynamic Address Table 8-4
8-4 Clearing the Dynamic Address Table 8-5
8-5 Configuring MAC Address Mirroring 8-6
Chapter 9 Spanning Tree Algorithm 9-1
9-1 Overview 9-1
STP 9-2
RSTP 9-2
MSTP 9-2
9-2 Configuring Loopback Detection 9-4
9-3 Configuring Global Settings for STA 9-5
Displaying Global Settings for STA 9-11
9-4 Configuring Interface Settings for STA 9-12
9-5 Displaying Interface Settings for STA 9-16
9-6 Configuring Multiple Spanning Trees 9-19
9-7 Configuring Interface Settings for MSTP 9-22
Chapter 10 Congestion Control 10-1
10-1 Rate Limiting 10-1

10-2 Storm Control 10-4
10-3 Automatic Traffic Control 10-6
Setting the ATC Timers 10-7
Configuring ATC Thresholds and Responses 10-9
Chapter 11 Class of Service 11-1
11-1 Layer 2 Queue Settings 11-1
Setting the Default Priority for Interfaces 11-1
Selecting the Queue Mode 11-2
Mapping CoS Values to Egress Queues 11-5
11-2 Layer 3/4 Priority Settings 11-7
Mapping Layer 3/4 Priorities to CoS Values 11-7
Setting Priority Processing to DSCP or CoS 11-8
Mapping Ingress DSCP Values to Internal DSCP Values 11-9
Mapping CoS Priorities to Internal DSCP Values 11-11
Chapter 12 Quality of Service 12-1
12-1 Overview 12-1
12-2 Configuring a Class Map 12-2
12-3 Creating QoS Policies 12-5
12-4 Attaching a Policy Map to a Port 12-14
Chapter 13 VoIP Traffic Configuration 13-1
13-1 Overview 13-1
13-2 Configuring VoIP Traffic 13-1
13-3 Configuring Telephony OUI 13-3
13-4 Configuring VoIP Traffic Ports 13-4
Chapter 14 Security Measures 14-1
14-1 AAA Authorization and Accounting 14-2
Configuring Local/Remote Logon Authentication 14-3
Configuring Remote Logon Authentication Servers 14-4
Configuring AAA Accounting 14-9
Configuring AAA Authorization 14-14
14-2 Configuring User Accounts 14-17
14-3 Web Authentication 14-19
Configuring Global Settings for Web Authentication 14-19
Configuring Interface Settings for Web Authentication 14-21
14-4 Network Access (MAC Address Authentication) 14-22

Configuring Global Settings for Network Access 14-24
Configuring Network Access for Ports 14-25
Configuring Port Link Detection 14-27
Configuring a MAC Address Filter 14-28
Displaying Secure MAC Address Information 14-30
14-5 Configuring HTTPS 14-31
Configuring Global Settings for HTTPS 14-31
Replacing the Default Secure-site Certificate 14-33
14-6 Configuring the Secure Shell 14-34
Configuring the SSH Server 14-37
Generating the Host Key Pair 14-38
Importing User Public Keys 14-40
14-7 Access Control Lists 14-42
Showing TCAM Utilization 14-43
Setting the ACL Name and Type 14-44
Configuring a Standard IPv4 ACL 14-45
Configuring an Extended IPv4 ACL 14-47
Configuring a Standard IPv6 ACL 14-50
Configuring an Extended IPv6 ACL 14-52
Configuring a MAC ACL 14-54
Configuring an ARP ACL 14-56
Binding a Port to an Access Control List 14-58
14-8 ARP Inspection 14-59
Configuring Global Settings for ARP Inspection 14-60
Configuring VLAN Settings for ARP Inspection 14-62
Configuring Interface Settings for ARP Inspection 14-63
Displaying ARP Inspection Statistics 14-65
Displaying the ARP Inspection Log 14-66
14-9 Filtering IP Addresses for Management Access 14-67
14-10 Configuring Port Security 14-69
14-11 Configuring 802.1X Port Authentication 14-72
Configuring 802.1X Global Settings 14-74
Configuring Port Authenticator Settings for 802.1X 14-75
Configuring Port Supplicant Settings for 802.1X 14-79
Displaying 802.1X Statistics 14-81
14-12 IP Source Guard 14-84
Configuring Ports for IP Source Guard 14-84
Configuring Static Bindings for IP Source Guard 14-86

Displaying Information for Dynamic IP Source Guard Bindings 14-88
14-13 DHCP Snooping 14-89
DHCP Snooping Configuration 14-91
DHCP Snooping VLAN Configuration 14-92
Displaying DHCP Snooping Binding Information 14-95
Chapter 15 Basic Administration Protocols 15-1
15-1 Configuring Event Logging 15-1
System Log Configuration 15-1
Remote Log Configuration 15-4
Sending Simple Mail Transfer Protocol Alerts 15-5
15-2 Link Layer Discovery Protocol 15-8
Setting LLDP Timing Attributes 15-8
Configuring LLDP Interface Attributes 15-10
Configuring LLDP Interface Civic-Address 15-14
Displaying LLDP Local Device Information 15-16
Displaying LLDP Remote Port Information 15-19
Displaying Device Statistics 15-23
15-3 Power Over Ethernet 15-25
Displaying the Switch's Overall PoE Power Budget 15-26
Setting The Port PoE Power Budget 15-27
15-4 Simple Network Management Protocol 15-29
Configuring Global Settings for SNMP 15-32
Setting the Local Engine ID 15-33
Specifying a Remote Engine ID 15-34
Setting SNMPv3 Views 15-35
Configuring SNMPv3 Groups 15-38
Setting Community Access Strings 15-43
Configuring Local SNMPv3 Users 15-44
Configuring Remote SNMPv3 Users 15-46
Specifying Notification Managers 15-49
15-5 Remote Monitoring 15-53
Configuring RMON Alarms 15-53
Configuring RMON Events 15-57
Configuring RMON History Samples 15-60
Configuring RMON Statistical Samples 15-63
15-6 Switch Clustering 15-66
Configuring General Settings for Clusters 15-67
Cluster Member Configuration 15-68

15-7 Setting A Time Range 15-71
Chapter 16 IP Configuration 16-1
16-1 Using the Ping Function 16-1
16-2 Address Resolution Protocol 16-3
Setting the ARP Timeout 16-3
Displaying ARP Entries 16-4
16-3 Setting the Switch's IP Address (IP Version 4) 16-5
16-4 Setting the Switch's IP Address (IP Version 6) 16-7
Configuring the IPv6 Default Gateway 16-8
Configuring IPv6 Interface Settings 16-9
Configuring an IPv6 Address 16-10
Showing IPv6 Addresses 16-13
Showing the IPv6 Neighbor Cache 16-14
Showing IPv6 Statistics 16-16
Chapter 17 IP Services 17-1
17-1 Configuring General DNS Service Parameters 17-1
17-2 Configuring a List of Domain Names 17-2
17-3 Configuring a List of Name Servers 17-4
17-4 Configuring Static DNS Host to Address Entries 17-5
17-5 Displaying the DNS Cache 17-6
Chapter 18 Multicast Filtering 18-1
18-1 Overview 18-1
18-2 Layer 2 IGMP (Snooping and Query) 18-2
Configuring IGMP Snooping and Query Parameters 18-4
Specifying Static Interfaces for a Multicast Router 18-8
Assigning Interfaces to Multicast Services 18-10
Setting IGMP Snooping Status per Interface 18-12
Displaying Multicast Groups Discovered by IGMP Snooping 18-17
18-3 Filtering and Throttling IGMP Groups 18-18
Enabling IGMP Filtering and Throttling 18-18
Configuring IGMP Filter Profiles 18-19
Configuring IGMP Filtering and Throttling for Interfaces 18-22
18-4 Multicast VLAN Registration 18-23
Configuring Global MVR Settings 18-25
Configuring MVR Interface Status 18-26
Assigning Static Multicast Groups to Interfaces 18-28

Showing Multicast Group Members 18-30
Chapter 19 Using the Command Line Interface 19-1
19-1 Accessing the CLI 19-1
Console Connection 19-1
Telnet Connection 19-2
19-2 Entering Commands 19-3
Keywords and Arguments 19-3
Minimum Abbreviation 19-3
Command Completion 19-3
Getting Help on Commands 19-3
Showing Commands 19-4
Partial Keyword Lookup 19-6
Negating the Effect of Commands 19-6
Using Command History 19-6
Understanding Command Modes 19-6
Exec Commands 19-7
Configuration Commands 19-8
Command Line Processing 19-9
Showing Status Information 19-10
Output Modifiers 19-11
19-3 CLI Command Groups 19-11
Chapter 20 General Commands 20-1
prompt 20-1
reload (Global Configuration) 20-2
enable 20-3
quit 20-4
show history 20-4
configure 20-5
disable 20-6
reload (Privileged Exec) 20-6
show reload 20-7
end 20-7
exit 20-8
Chapter 21 System Management Commands 21-1
21-1 Device Designation 21-2
hostname 21-2
21-2 System Status 21-3
show access-list tcam-utilization 21-3

show memory 21-4
show process cpu 21-4
show running-config 21-4
show startup-config 21-7
show system 21-8
show tech-support 21-9
show users 21-10
show version 21-11
21-3 Frame Size 21-12
jumbo frame 21-12
21-4 File Management 21-13
boot system 21-14
copy 21-15
delete 21-18
dir 21-18
whichboot 21-20
upgrade opcode auto 21-20
upgrade opcode path 21-22
21-5 Line 21-23
line 21-24
databits 21-25
exec-timeout 21-26
login 21-27
parity 21-28
password 21-29
password-thresh 21-30
silent-time 21-31
speed 21-32
stopbits 21-33
timeout login response 21-34
disconnect 21-35
show line 21-36
21-6 Event Logging 21-37
logging facility 21-37
logging history 21-38
logging host 21-39
logging on 21-40
logging trap 21-41
clear log 21-42

show log 21-43
show logging 21-44
21-7 SMTP Alerts 21-46
logging sendmail 21-46
logging sendmail host 21-47
logging sendmail level 21-48
logging Sendmail Destination-Email 21-49
logging Sendmail Source-Email 21-50
show logging sendmail 21-50
21-8 Time 21-51
sntp client 21-52
sntp poll 21-53
sntp server 21-54
show sntp 21-55
clock timezone 21-56
clock timezone-predefined 21-57
calendar set 21-58
Syntax 21-58
show calendar 21-59
21-9 Time Range 21-59
time-range 21-60
absolute 21-61
periodic 21-62
show time-range 21-63
21-10 Switch Clustering 21-64
cluster 21-65
cluster commander 21-66
cluster ip-pool 21-66
cluster member 21-67
rcommand 21-68
show cluster 21-69
show cluster members 21-69
show cluster candidates 21-70
Chapter 22 SNMP Commands 22-1
snmp-server 22-2
snmp-server community 22-3
snmp-server contact 22-4
snmp-server location 22-5
show snmp 22-6

snmp-server enable traps 22-7
snmp-server host 22-8
snmp-server engine-id 22-10
snmp-server group 22-12
snmp-server user 22-13
snmp-server view 22-15
show snmp engine-id 22-16
show snmp group 22-16
show snmp user 22-17
show snmp view 22-18
nlm 22-19
snmp-server notify-filter 22-19
show nlm oper-status 22-21
show snmp notify-filter 22-22

Chapter 23 Remote Monitoring Commands 23-1

rmon alarm 23-2
rmon event 23-3
rmon collection history 23-4
rmon collection rmon1 23-5
show rmon alarms 23-6
show rmon events 23-6
show rmon history 23-6
show rmon statistics 23-8

Chapter 24 Authentication Commands 24-1

24-1 User Accounts 24-2
enable password 24-2
username 24-3
24-2 Authentication Sequence 24-4
authentication enable 24-4
authentication login 24-6
24-3 RADIUS Client 24-7
radius-server acct-port 24-7
radius-server auth-port 24-8
radius-server host 24-9
radius-server key 24-10
radius-server retransmit 24-10
radius-server timeout 24-11
show radius-server 24-12

24-4 TACACS+ Client 24-13
tacacs-server host 24-13
tacacs-server key 24-14
tacacs-server port 24-15
show tacacs-server 24-15
24-5 AAA 24-16
aaa accounting commands 24-17
aaa accounting dot1x 24-18
aaa accounting exec 24-19
aaa accounting update 24-20
aaa authorization exec 24-21
aaa group server 24-22
server 24-22
accounting dot1x 24-23
accounting exec 24-24
authorization exec 24-25
show accounting 24-26
24-6 Web Server 24-27
ip http port 24-27
ip http server 24-28
ip http secure-server 24-28
ip http secure-port 24-30
24-7 Telnet Server 24-31
ip telnet max-sessions 24-31
ip telnet port 24-32
ip telnet server 24-33
show ip telnet 24-33
24-8 Secure Shell 24-34
ip ssh authentication-retries 24-37
ip ssh server 24-38
ip ssh server-key size 24-39
ip ssh timeout 24-40
delete public-key 24-40
ip ssh crypto host-key generate 24-41
ip ssh crypto zeroize 24-42
ip ssh save host-key 24-43
show ip ssh 24-43
show public-key 24-44
show ssh 24-44

24-9 802.1X Port Authentication 24-46
dot1x default 24-47
dot1x eapol-pass-through 24-47
dot1x system-auth-control 24-48
dot1x intrusion-action 24-48
dot1x max-req 24-49
dot1x operation-mode 24-50
dot1x port-control 24-51
dot1x re-authentication 24-52
dot1x timeout quiet-period 24-53
dot1x timeout re-authperiod 24-54
dot1x timeout supp-timeout 24-55
dot1x timeout tx-period 24-56
dot1x re-authenticate 24-57
dot1x identity profile 24-58
dot1x max-start 24-59
dot1x pae supplicant 24-60
dot1x timeout auth-period 24-61
dot1x timeout held-period 24-62
dot1x timeout start-period 24-63
show dot1x 24-64
24-10 Management IP Filter 24-67
management 24-67
show management 24-69
Chapter 25 General Security Measures 25-1
25-1 Port Security 25-2
port security 25-2
25-2 Network Access (MAC Address Authentication) 25-4
network-access aging 25-5
network-access mac-filter 25-6
mac-authentication reauth-time 25-7
network-access dynamic-qos 25-8
network-access dynamic-vlan 25-9
network-access guest-vlan 25-10
network-access link-detection 25-10
network-access link-detection link-down 25-11
network-access link-detection link-up 25-12
network-access link-detection link-up-down 25-12
network-access max-mac-count 25-13

network-access mode mac-authentication 25-14
network-access port-mac-filter 25-15
mac-authentication intrusion-action 25-15
mac-authentication max-mac-count 25-16
clear network-access 25-17
show network-access 25-18
show network-access mac-address-table 25-19
show network-access mac-filter 25-20
25-3 Web Authentication 25-20
web-auth login-attempts 25-21
web-auth quiet-period 25-22
web-auth session-timeout 25-22
web-auth system-auth-control 25-23
web-auth 25-24
web-auth re-authenticate (Port) 25-24
web-auth re-authenticate (IP) 25-25
show web-auth 25-26
show web-auth interface 25-26
show web-auth summary 25-27
25-4 DHCP Snooping 25-28
ip dhcp snooping 25-28
ip dhcp snooping database flash 25-30
ip dhcp snooping information option 25-31
ip dhcp snooping information policy 25-32
ip dhcp snooping verify mac-address 25-33
ip dhcp snooping vlan 25-34
ip dhcp snooping trust 25-35
clear ip dhcp snooping database flash 25-36
show ip dhcp snooping 25-36
show ip dhcp snooping binding 25-37
25-5 IP Source Guard 25-37
ip source-guard binding 25-38
ip source-guard 25-39
ip source-guard max-binding 25-41
show ip source-guard 25-42
show ip source-guard binding 25-42
25-6 ARP Inspection 25-43
ip arp inspection 25-44
ip arp inspection filter 25-45

ip arp inspection log-buffer logs 25-46
ip arp inspection validate 25-47
ip arp inspection vlan 25-48
ip arp inspection limit 25-49
ip arp inspection trust 25-50
show ip arp inspection configuration 25-50
show ip arp inspection interface 25-51
show ip arp inspection log 25-51
show ip arp inspection statistics 25-51
show ip arp inspection vlan 25-53

Chapter 26 Access Control Lists 26-1

26-1 IPv4 ACLs 26-1
access-list ip 26-2
permit, deny, redirect-to (Standard IP ACL) 26-3
permit, deny, redirect-to (Extended IPv4 ACL) 26-4
ip access-group 26-8
show ip access-group 26-8
show ip access-list 26-9
26-2 IPv6 ACLs 26-10
access-list ipv6 26-11
permit, deny, redirect-to (Standard IPv6 ACL) 26-12
permit, deny, redirect-to (Extended IPv6 ACL) 26-13
show ipv6 access-list 26-15
ipv6 access-group 26-16
show ipv6 access-group 26-17
26-3 MAC ACLs 26-17
access-list mac 26-18
permit, deny, redirect-to (MAC ACL) 26-19
mac access-group 26-22
show mac access-group 26-23
show mac access-list 26-23
26-4 ARP ACLs 26-23
access-list arp 26-24
permit, deny (ARP ACL) 26-25
show arp access-list 26-26
26-5 ACL Information 26-27
show access-group 26-27
show access-list 26-28

Chapter 27 Interface Commands 27-1
interface 27-2
alias 27-3
capabilities 27-4
description 27-5
flowcontrol 27-6
giga-phy-mode 27-7
media-type 27-8
negotiation 27-9
shutdown 27-10
speed-duplex 27-10
switchport packet-rate 27-12
clear counters 27-13
show interfaces counters 27-14
show interfaces status 27-15
show interfaces switchport 27-16
show interfaces transceiver 27-19
test cable-diagnostics 27-20
show cable-diagnostics 27-22
power-save 27-22
show power-save 27-24
Chapter 28 Link Aggregation Commands 28-1
channel-group 28-2
lacp 28-3
lacp admin-key (Ethernet Interface) 28-5
lacp port-priority 28-6
lacp system-priority 28-7
lacp admin-key (Port Channel) 28-8
show lacp 28-9
Chapter 29 Power Over Ethernet Commands 29-1
power inline compatible 29-1
power inline 29-3
power inline maximum allocation 29-4
power inline priority 29-4
power inline time-range 29-6
show power inline status 29-6
show power inline time-range 29-8
show power poe 29-9

Chapter 30 Port Mirroring Commands 30-1
30-1 Local Port Mirroring Commands 30-1
port monitor 30-2
show port monitor 30-4
30-2 RSPAN Mirroring Commands 30-5
rspan source 30-6
rspan destination 30-7
rspan remote vlan 30-8
no rspan session 30-10
show rspan 30-11
Chapter 31 Rate Limit Commands 31-1
rate-limit 31-1
Chapter 32 Automatic Traffic Control Commands 32-1
auto-traffic-control apply-timer 32-2
auto-traffic-control release-timer 32-3
auto-traffic-control 32-3
auto-traffic-control action 32-4
auto-traffic-control alarm-clear-threshold 32-6
auto-traffic-control alarm-fire-threshold 32-7
auto-traffic-control auto-control-release 32-8
auto-traffic-control control-release 32-9
snmp-server enable port-traps atc broadcast-alarm-clear 32-10
snmp-server enable port-traps atc broadcast-alarm-fire 32-11
snmp-server enable port-traps atc broadcast-control-apply 32-12
snmp-server enable port-traps atc broadcast-control-release 32-13
snmp-server enable port-traps atc multicast-alarm-clear 32-14
snmp-server enable port-traps atc multicast-alarm-fire 32-15
snmp-server enable port-traps atc multicast-control-apply 32-16
snmp-server enable port-traps atc multicast-control-release 32-17
show auto-traffic-control 32-18
show auto-traffic-control interface 32-18
Chapter 33 Address Table Commands 33-1
mac-address-table aging-time 33-2
mac-address-table static 33-2
clear mac-address-table dynamic 33-4
show mac-address-table 33-4
show mac-address-table aging-time 33-5
show mac-address-table count 33-6

Chapter 34 Spanning Tree Commands 34-1
spanning-tree 34-2
spanning-tree cisco-prestandard 34-3
spanning-tree forward-time 34-3
spanning-tree hello-time 34-4
spanning-tree max-age 34-5
spanning-tree mode 34-6
spanning-tree pathcost method 34-7
spanning-tree priority 34-8
spanning-tree mst configuration 34-9
spanning-tree transmission-limit 34-10
max-hops 34-11
mst priority 34-12
mst vlan 34-13
name 34-14
revision 34-15
spanning-tree bpdu-filter 34-16
spanning-tree bpdu-guard 34-17
spanning-tree cost 34-18
spanning-tree edge-port 34-19
spanning-tree link-type 34-20
spanning-tree loopback-detection 34-20
spanning-tree loopback-detection release-mode 34-22
spanning-tree loopback-detection trap 34-23
spanning-tree mst cost 34-23
spanning-tree mst port-priority 34-25
spanning-tree port-priority 34-26
spanning-tree root-guard 34-27
spanning-tree spanning-disabled 34-28
spanning-tree loopback-detection release 34-28
spanning-tree protocol-migration 34-29
show spanning-tree 34-30
show spanning-tree mst configuration 34-32
Chapter 35 VLAN Commands 35-1
35-1 GVRP and Bridge Extension Commands 35-2
bridge-ext gvrp 35-2
garp timer 35-3
switchport forbidden vlan 35-4
switchport gvrp 35-5

show bridge-ext 35-6
show garp timer 35-6
show gvrp configuration 35-7
35-2 Editing VLAN Groups 35-8
vlan database 35-8
vlan 35-9
35-3 Configuring VLAN Interfaces 35-10
interface vlan 35-11
switchport acceptable-frame-types 35-12
switchport allowed vlan 35-13
switchport ingress-filtering 35-14
switchport mode 35-14
switchport native vlan 35-16
vlan-trunking 35-17
35-4 Displaying VLAN Information 35-18
show vlan 35-18
35-5 Configuring IEEE 802.1Q Tunneling 35-20
dot1q-tunnel system-tunnel-control 35-21
switchport dot1q-tunnel mode 35-22
switchport dot1q-tunnel tpid 35-23
show dot1q-tunnel 35-24
35-6 Configuring Port-based Traffic Segmentation 35-24
traffic-segmentation 35-24
show traffic-segmentation 35-25
35-7 Configuring Protocol-based VLANs 35-26
protocol-vlan protocol-group (Configuring Groups) 35-27
protocol-vlan protocol-group (Configuring Interfaces) 35-28
show protocol-vlan protocol-group 35-29
show interfaces protocol-vlan protocol-group 35-30
35-8 Configuring IP Subnet VLANs 35-31
subnet-vlan 35-31
show subnet-vlan 35-32
35-9 Configuring MAC Based VLANs 35-33
mac-vlan 35-33
show mac-vlan 35-34
35-10 Configuring Voice VLANs 35-35
voice vlan 35-36
voice vlan aging 35-37

voice vlan mac-address 35-38
switchport voice vlan 35-39
switchport voice vlan priority 35-40
switchport voice vlan rule 35-41
switchport voice vlan security 35-42
show voice vlan 35-43

Chapter 36 Class of Service Commands 36-1

36-1 Priority Commands (Layer 2) 36-1
queue mode 36-2
queue weight 36-4
switchport priority default 36-5
show queue mode 36-6
show queue weight 36-6
36-2 Priority Commands (Layer 3 and 4) 36-7
qos map cos-dscp 36-7
qos map dscp-mutation 36-9
qos map phb-queue 36-10
qos map trust-mode 36-12
show qos map dscp-mutation 36-13
show qos map phb-queue 36-14
show qos map cos-dscp 36-15
show qos map trust-mode 36-16

Chapter 37 Quality of Service Commands 37-1

class-map 37-2
description 37-3
match 37-4
rename 37-5
policy-map 37-6
class 37-7
police flow 37-8
police srtcm-color 37-9
police trtcm-color 37-12
set cos 37-14
set ip dscp 37-15
set phb 37-16
service-policy 37-17
show class-map 37-18
show policy-map 37-19
show policy-map interface 37-20

Chapter 38 Multicast Filtering Commands 38-1
38-1 IGMP Snooping 38-1
ip igmp snooping 38-3
ip igmp snooping proxy-reporting 38-4
ip igmp snooping querier 38-5
ip igmp snooping router-alert-option-check 38-6
ip igmp snooping router-port-expire-time 38-7
ip igmp snooping tcn-flood 38-7
ip igmp snooping tcn-query-solicit 38-9
ip igmp snooping unregistered-data-flood 38-10
ip igmp snooping unsolicited-report-interval 38-11
ip igmp snooping version 38-12
ip igmp snooping version-exclusive 38-13
ip igmp snooping vlan general-query-suppression 38-14
ip igmp snooping vlan immediate-leave 38-15
ip igmp snooping vlan last-memb-query-count 38-16
ip igmp snooping vlan last-memb-query-intvl 38-17
ip igmp snooping vlan mrd 38-18
ip igmp snooping vlan proxy-address 38-19
ip igmp snooping vlan proxy-query-interval 38-20
ip igmp snooping vlan proxy-query-resp-intvl 38-21
ip igmp snooping vlan static 38-22
show ip igmp snooping 38-23
show ip igmp snooping group 38-24
38-2 Static Multicast Routing 38-25
ip igmp snooping vlan mrouter 38-25
show ip igmp snooping mrouter 38-26
38-3 IGMP Filtering and Throttling 38-27
ip igmp filter (Global Configuration) 38-28
ip igmp profile 38-28
permit, deny 38-29
range 38-30
ip igmp filter (Interface Configuration) 38-30
ip igmp max-groups 38-31
ip igmp max-groups action 38-32
show ip igmp filter 38-32
show ip igmp profile 38-33
show ip igmp throttle interface 38-34
38-4 Multicast VLAN Registration 38-35

mvr 38-35
mvr immediate-leave 38-37
mvr type 38-38
mvr vlan group 38-39
show mvr 38-40

Chapter 39 LLDP Commands 39-1

lldp 39-3
lldp holdtime-multiplier 39-3
lldp med-fast-start-count 39-4
lldp notification-interval 39-4
lldp refresh-interval 39-5
lldp reinit-delay 39-6
lldp tx-delay 39-6
lldp admin-status 39-7
lldp basic-tlv management-ip-address 39-8
lldp basic-tlv port-description 39-8
lldp basic-tlv system-capabilities 39-9
lldp basic-tlv system-description 39-10
lldp basic-tlv system-name 39-10
lldp dot1-tlv proto-ident 39-11
lldp dot1-tlv proto-vid 39-12
lldp dot1-tlv pvid 39-12
lldp dot1-tlv vlan-name 39-13
lldp dot3-tlv link-agg 39-13
lldp dot3-tlv mac-phy 39-14
lldp dot3-tlv max-frame 39-14
lldp dot3-tlv poe 39-15
lldp med-location civic-addr 39-16
lldp med-notification 39-18
lldp med-tlv ext-poe 39-18
lldp med-tlv inventory 39-19
lldp med-tlv location 39-20
lldp med-tlv med-cap 39-20
lldp med-tlv network-policy 39-21
lldp notification 39-21
show lldp config 39-22
show lldp info local-device 39-24
show lldp info remote-device 39-25
show lldp info statistics 39-26

Chapter 40 Domain Name Service Commands 40-1
ip domain-list 40-2
ip domain-lookup 40-3
ip domain-name 40-4
ip host 40-5
ip name-server 40-6
ipv6 host 40-7
clear dns cache 40-7
clear host 40-8
show dns 40-8
show dns cache 40-9
show hosts 40-10
Chapter 41 DHCP Commands 41-1
41-1 DHCP Client 41-1
ip dhcp client class-id 41-2
ip dhcp restart client 41-3
ipv6 dhcp restart client vlan 41-4
show ip dhcp client-identifier 41-5
show ipv6 dhcp duid 41-5
show ipv6 dhcp vlan 41-5
Chapter 42 IP Interface Commands 42-1
42-1 IPv4 Interface 42-1
Basic IPv4 Configuration 42-2
ip address 42-2
ip default-gateway 42-4
show ip default-gateway 42-5
show ip interface 42-5
traceroute 42-6
ping 42-7
ARP Configuration 42-8
arp timeout 42-8
clear arp-cache 42-9
show arp 42-10
42-2 IPv6 Interface 42-11
ipv6 default-gateway 42-12
ipv6 address 42-13
ipv6 address autoconfig 42-14
ipv6 address eui-64 42-16

ipv6 address link-local 42-18
ipv6 enable 42-19
show ipv6 default-gateway 42-20
show ipv6 interface 42-21
show ipv6 traffic 42-23
clear ipv6 traffic 42-28
ping6 42-28
clear ipv6 neighbors 42-29
show ipv6 neighbors 42-30

Appendix A Software Specifications A-1

A-1 Software Features A-1
A-2 Management Features A-2
A-3 Standards A-3
A-4 Management Information Bases A-4

Appendix B Troubleshooting B-1

B-1 Problems Accessing the Management Interface B-1
B-2 Using System Logs B-2

Appendix C License Information C-1

C-1 The GNU General Public License C-1

Notes

Chapter 1
Introduction

This section provides an overview of the switch, and introduces some basic concepts about network switches. It also describes the basic settings required to access the management interface.

These switches provide a broad range of features for Layer 2 switching. It includes a management agent that allows you to configure the features listed in this manual. The default configuration can be used for most of the features provided by this switch. However, there are many options that you should configure to maximize the switch's performance for your particular network environment.

1-1 Key Features

Table 1-1. Key Features

Feature	Description
Configuration Backup and Restore	Using management station or FTP/TFTP server
Authentication	Console, Telnet, web – user name/password, RADIUS, TACACS+ Web – HTTPS Telnet – SSH SNMP v1/2c - Community strings SNMP version 3 – MD5 or SHA password Port – IEEE 802.1X, MAC address filtering
General Security Measures	Private VLANs Port Authentication Port Security DHCP Snooping IP Source Guard
Access Control Lists	Supports up to 512 rules, 64 ACLs, and a maximum of 32 rules for an ACL
DHCP	Client
DNS	Client and Proxy service
Port Configuration	Speed and duplex mode and flow control
Port Trunking	Supports up to 12 trunks – static or dynamic trunking (LACP)
Port Mirroring	50 sessions, one or more source ports to one analysis port
Congestion Control	Rate Limiting Throttling for broadcast, multicast, unknown unicast storms Random Early Detection
Address Table	16K MAC addresses in the forwarding table, 1K static MAC addresses, 256 L2 multicast groups

Table 1-1. Key Features (Continued)

Feature	Description
IP Version 4	Supports IPv4 addressing, and management
IEEE 802.1D Bridge	Supports dynamic data switching and addresses learning
Store-and-Forward Switching	Supported to ensure wire-speed switching while eliminating bad frames
Spanning Tree Algorithm	Supports standard STP, Rapid Spanning Tree Protocol (RSTP), and Multiple Spanning Trees (MSTP)
Virtual LANs	Up to 256 using IEEE 802.1Q, port-based, protocol-based, private VLANs, voice VLANs, and QinQ tunnel
Traffic Prioritization	Default port priority, traffic class map, queue scheduling, Differentiated Services Code Point (DSCP
Qualify of Service	Supports Differentiated Services (DiffServ)
Link Layer Discovery Protocol	Used to discover basic information about neighboring devices
Multicast Filtering	Supports IGMP snooping and query and Multicast VLAN Registration

1-2 Description of Software Features

The switch provides a wide range of advanced performance enhancing features. Flow control eliminates the loss of packets due to bottlenecks caused by port saturation. Storm suppression prevents broadcast, multicast, and unknown unicast traffic storms from engulfing the network. Untagged (port-based), tagged, and protocol-based VLANs, plus support for automatic GVRP VLAN registration provide traffic security and efficient use of network bandwidth. CoS priority queueing ensures the minimum delay for moving real-time multimedia data across the network. While multicast filtering provides support for real-time network applications.

Some of the management features are briefly described below.

Configuration Backup and Restore

You can save the current configuration settings to a file on the management station (using the web interface) or an FTP/TFTP server (using the web or console interface), and later download this file to restore the switch configuration settings.

Authentication

This switch authenticates management access via the console port, Telnet, or a web browser. User names and passwords can be configured locally or can be verified via a remote authentication server (i.e., RADIUS or TACACS+). Port-based authentication is also supported via the IEEE 802.1X protocol. This protocol uses Extensible Authentication Protocol over LANs (EAPOL) to request user credentials from the 802.1X client, and then uses the EAP between the switch and the authentication server to verify the client's right to access the network via an authentication server (i.e., RADIUS or TACACS+ server).

Other authentication options include HTTPS for secure management access via the web, SSH for secure management access over a Telnet-equivalent connection, SNMP Version 3, IP address filtering for SNMP/Telnet/web management access, and MAC address filtering for port access.

Access Control Lists

ACLs provide packet filtering for IP frames (based on address, protocol, TCP/UDP port number or TCP control code) or any frames (based on MAC address or Ethernet type). ACLs can be used to improve performance by blocking unnecessary network traffic or to implement security controls by restricting access to specific network resources or protocols.

Port Configuration

You can manually configure the speed and duplex mode, and flow control used on specific ports, or use auto-negotiation to detect the connection settings used by the attached device. Use the full-duplex mode on ports whenever possible to double the throughput of switch connections. Flow control should also be enabled to control network traffic during periods of congestion and prevent the loss of packets when port buffer thresholds are exceeded. The switch supports flow control based on the IEEE 802.3x standard (now incorporated in IEEE 802.3-2002).

Port Mirroring

The switch can unobtrusively mirror traffic from any port to a monitor port. You can then attach a protocol analyzer or RMON probe to this port to perform traffic analysis and verify connection integrity.

Port Trunking

Ports can be combined into an aggregate connection. Trunks can be manually set up or dynamically configured using Link Aggregation Control Protocol (LACP – IEEE 802.3-2005). The additional ports dramatically increase the throughput across any connection, and provide redundancy by taking over the load if a port in the trunk should fail. The switch supports up to 12 trunks.

Rate Limiting

This feature controls the maximum rate for traffic transmitted or received on an interface. Rate limiting is configured on interfaces at the edge of a network to limit traffic into or out of the network. Traffic that falls within the rate limit is transmitted, while packets that exceed the acceptable amount of traffic are dropped.

Storm Control

Broadcast, multicast and unknown unicast storm suppression prevents traffic from overwhelming the network.When enabled on a port, the level of broadcast traffic passing through the port is restricted. If broadcast traffic rises above a pre-defined threshold, it will be throttled until the level falls back beneath the threshold.

Static Addresses

A static address can be assigned to a specific interface on this switch. Static addresses are bound to the assigned interface and will not be moved. When a static address is seen on another interface, the address will be ignored and will not be written to the address table. Static addresses can be used to provide network security by restricting access for a known host to a specific port.

IEEE 802.1D Bridge

The switch supports IEEE 802.1D transparent bridging. The address table facilitates data switching by learning addresses, and then filtering or forwarding traffic based on this information. The address table supports up to 16K addresses.

Store-and-Forward Switching

The switch copies each frame into its memory before forwarding them to another port. This ensures that all frames are a standard Ethernet size and have been verified for accuracy with the cyclic redundancy check (CRC). This prevents bad frames from entering the network and wasting bandwidth.

To avoid dropping frames on congested ports, the switch provides 8 MB for frame buffering. This buffer can queue packets awaiting transmission on congested networks.

Spanning Tree Algorithm

The switch supports these spanning tree protocols:

- Spanning Tree Protocol (STP, IEEE 802.1D) – This protocol provides loop detection. When there are multiple physical paths between segments, this protocol will choose a single path and disable all others to ensure that only one route exists between any two stations on the network. This prevents the creation of network loops. However, if the chosen path should fail for any reason, an alternate path will be activated to maintain the connection.
- Rapid Spanning Tree Protocol (RSTP, IEEE 802.1w) – This protocol reduces the convergence time for network topology changes to about 3 to 5 seconds, compared to 30 seconds or more for the older IEEE 802.1D STP standard. It is intended as a complete replacement for STP, but can still interoperate with switches running the older standard by automatically reconfiguring ports to STP-compliant mode if they detect STP protocol messages from attached devices.
- Multiple Spanning Tree Protocol (MSTP, IEEE 802.1s) – This protocol is a direct extension of RSTP. It can provide an independent spanning tree for different VLANs. It simplifies network management, provides for even faster convergence than RSTP by limiting the size of each region, and prevents VLAN members from being segmented from the rest of the group (as sometimes occurs with IEEE 802.1D STP).

Virtual LANs

The switch supports up to 256 VLANs. A Virtual LAN is a collection of network nodes that share the same collision domain regardless of their physical location or connection point in the network. The switch supports tagged VLANs based on the IEEE 802.1Q standard. Members of VLAN groups can be dynamically learned via GVRP, or ports can be manually assigned to a specific set of VLANs. This allows the switch to restrict traffic to the VLAN groups to which a user has been assigned. By segmenting your network into VLANs, you can:

- Eliminate broadcast storms which severely degrade performance in a flat network.
- Simplify network management for node changes/moves by remotely configuring VLAN membership for any port, rather than having to manually change the network connection.
- Provide data security by restricting all traffic to the originating VLAN.
- Use private VLANs to restrict traffic to pass only between data ports and the uplink ports, thereby isolating adjacent ports within the same VLAN, and allowing you to limit the total number of VLANs that need to be configured.
- Use protocol VLANs to restrict traffic to specified interfaces based on protocol type.

Traffic Prioritization

This switch prioritizes each packet based on the required level of service, using four priority queues with strict priority, scheduling, or a combination of strict and weighted queuing. It uses IEEE 802.1p and 802.1Q tags to prioritize incoming traffic based on input from the end-station application. These functions can be used to provide independent priorities for delay-sensitive data and best-effort data.

This switch also supports several common methods of prioritizing layer 3/4 traffic to meet application requirements. Traffic can be prioritized based on the priority bits in the IP frame's Type of Service (ToS) octet using DSCP. When these services are enabled, the priorities are mapped to a Class of Service value by the switch, and the traffic then sent to the corresponding output queue.

Quality of Service

Differentiated Services (DiffServ) provides policy-based management mechanisms used for prioritizing network resources to meet the requirements of specific traffic types on a per-hop basis. Each packet is classified upon entry into the network based on access lists, IP Precedence or DSCP values, or VLAN lists. Using access lists allows you select traffic based on Layer 2, Layer 3, or Layer 4 information contained in each packet. Based on network policies, different kinds of traffic can be marked for different kinds of forwarding.

Multicast Filtering

Specific multicast traffic can be assigned to its own VLAN to ensure that it does not interfere with normal network traffic and to guarantee real-time delivery by setting the required priority level for the designated VLAN. The switch uses IGMP Snooping and Query to manage multicast group registration.

System Defaults

The switch's system defaults are provided in the configuration file "Factory_Default_Config.cfg." To reset the switch defaults, this file should be set as the startup configuration file.

The following table lists some of the basic system defaults.

Table 1-2. System Defaults

Function	Parameter	Default
Console Port Connection	Baud Rate	9600 bps
	Data bits	8
	Stop bits	1
	Parity	none
	Local Console Timeout	0 (disabled)

Table 1-2. System Defaults (Continued)

Function	Parameter	Default
Authentication	Privileged Exec Level	Username “ADMIN” Password “ADMIN”
	Normal Exec Level	Username “guest” Password “guest”
	Enable Privileged Exec from Normal Exec Level	Password “super”
	RADIUS Authentication	Disabled
	TACACS+ Authentication	Disabled
	802.1X Port Authentication	Disabled
Web Management	HTTPS	Enabled
	SSH	Disabled
	Port Security	Disabled
	IP Filtering	Disabled
	HTTP Server	Enabled
	HTTP Port Number	80
	HTTP Secure Server	Disabled
	HTTP Secure Server Port	443
SNMP	SNMP Agent	Enabled
	Community Strings	“public” (read only) “private” (read/write)
	Traps	Authentication traps: enabled Link-up-down events: enabled
	SNMP V3	View: defaultview Group: public (read only); private (read/write)
Port Configuration	Admin Status	Enabled
	Auto-negotiation	Enabled
	Flow Control	Disabled
Port Trunking	Static Trunks	None
	LACP (all ports)	Disabled
Congestion Control	Rate Limiting	Disabled
	Storm Control	Broadcast: Disabled Multicast: Disabled Unknown Unicast: Disabled
Address Table	Aging Time	300 seconds
Spanning Tree Algorithm	Status	Enabled, RSTP (Defaults: RSTP standard)
	Edge Ports	Auto

Table 1-2. System Defaults (Continued)

Function	Parameter	Default
LLDP	Status	Enabled
Virtual LANs	Default VLAN	1
	PVID	1
	Acceptable Frame Type	All
	Ingress Filtering	Disabled
	Switchport Mode (Egress Mode)	Access
	GVRP (global)	Disabled
	GVRP (port interface)	Disabled
Traffic Prioritization	Ingress Port Priority	0
	Queue Mode	Strict-WRR
	Queue Weight	Queue: 0 1 2 3 Weight: 1 2 4 6
	Class of Service	Enabled
	IP DSCP Priority	Disabled
IP Settings	Management. VLAN	VLAN 1
	IP Address	192.168.100.103
	Subnet Mask	255.255.255.0
	Default Gateway	0.0.0.0
	DHCP	Client: Disabled Snooping: Disabled
	DNS	Proxy service
	BOOTP	Disabled
Multicast Filtering	IGMP Snooping (Layer 2)	Snooping: Disabled Querier: Disabled
	IGMP Proxy Reporting	Disabled
	IGMP (Layer 3)	Disabled
System Log	Status	Enabled
	Messages Logged to RAM	Levels 0-7 (all)
	Messages Logged to Flash	Levels 0-3
SMTP Email Alerts	Event Handler	Enabled (but no server defined)
SNTP	Clock Synchronization	Disabled

Chapter 2
System Safety

This chapter provides system safety procedures for use with both the SSE-G2252 and SSE-G2252P switches. Please read and understand this information before installing and using the switches.

2-1 Electrical Safety Precautions

Basic electrical safety precautions should be followed to protect yourself from harm and the switch from damage:

- Be aware of how to power on/off the as well as the room's emergency power-off switch, disconnection switch or electrical outlet. If an electrical accident occurs, you can then quickly remove power from the system.
- Do not work alone when working with high voltage components.
- When working around exposed electrical circuits, another person who is familiar with the power-off controls should be nearby to switch off the power if necessary.
- Use only one hand when working with powered-on electrical equipment. This is to avoid making a complete circuit, which will cause electrical shock. Use extreme caution when using metal tools, which can easily damage any electrical components or circuit boards they come into contact with.
- Do not use mats designed to decrease electrostatic discharge as protection from electrical shock. Instead, use rubber mats that have been specifically designed as electrical insulators.

2-2 General Safety Precautions

Follow these rules to ensure general safety:

- Keep the area around the switch clean and free of clutter.
- Place the switch module cover and any system components that have been removed away from the system or on a table so that they won't accidentally be stepped on.
- While working on the system, do not wear loose clothing such as neckties and unbuttoned shirt sleeves, which can come into contact with electrical circuits or be pulled into a cooling fan.
- Remove any jewelry or metal objects from your body, which are excellent metal conductors that can create short circuits and harm you if they come into contact with printed circuit boards or areas where power is present.
- After accessing the inside of the system, replace the switch module's cover before installing it back into the blade enclosure.

2-3 Electrostatic Discharge Precautions

Electrostatic discharge (ESD) is generated by two objects with different electrical charges coming into contact with each other. An electrical discharge is created to neutralize this difference, which can damage electronic components and printed circuit boards.

The following measures are generally sufficient to neutralize this difference **before** contact is made to protect your equipment from ESD:

- Use a grounded wrist strap designed to prevent static discharge.
- Keep all components and printed circuit boards (PCBs) in their antistatic bags until ready for use.
- Touch a grounded metal object before removing the board from the antistatic bag.
- Do not let components or PCBs come into contact with your clothing, which may retain a charge even if you are wearing a wrist strap.
- Handle a board by its edges only; do not touch its components, peripheral chips, memory modules or contacts.
- When handling chips or modules, avoid touching their pins.
- Put the mainboard and peripherals back into their antistatic bags when not in use.
- For grounding purposes, make sure the blade enclosure provides excellent conductivity between the power supplies, the blade modules and the mainboard.

2-4 Operating Precautions

Care must be taken to assure that the cover of the switch is in place when it is operating to assure proper cooling. Out of warranty damage to the switch can occur if this practice is not strictly followed.

2-5 Compliances and Safety

FCC Class A

This device complies with Part 15 rules. Operation is subject to the following two conditions;

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

You may use unshielded twisted-pair (UTP) for RJ-45 connections - Category 3 or better for 10 Mbps connections, Category 5 or better for 100 Mbps connections, Category 5, 5e, or 6 for 1000 Mbps connections. For fiber optic connections, you may use 50/125 or 62.5/125 micron multimode fiber or 9/125 micron single-mode fiber.

Industry Canada - Class A

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled “Digital Apparatus,” ICES-003 of the Department of Communications.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: “Appareils Numériques,” NMB-003 édictée par le ministère des Communications.

CE Mark Declaration of Conformance for EMI and Safety (EEC)

This information technology equipment complies with the requirements of the Council Directive 2004/108/EC on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility and 2006/95/EC for electrical equipment used within certain voltage limits and the Amendment Directive 93/68/EEC. For the evaluation of the compliance with these Directives, the following standards were applied to the SSE-G2252 and SSE-G2252P switches.

RFI Emission:	Limited class A according to EN 55022:2010
	Limited class A for harmonic current emission according to EN 61000-3-2/2006
	Limitation of voltage fluctuation and flicker in low- voltage supply system according to EN 61000-3-3/ 2008
Immunity:	Product family standard according to EN 55024:2010
	Electrostatic Discharge according to EN 61000-4-2:2008 (Contact Discharge: ±4 kV, Air discharge: ±8 kV)
	Radio-frequency electromagnetic field according to EN 61000-4-3:2010 (80 – 1000 MHz with 1 kHz AM 80% Modulation: 3 V/m)
	Electrical fast transient/burst according to EN 61000- 4-4:2004 (AC/DC power supply: ±1 kV, Data/Signal lines: ±5 kV)
	Surge immunity test according to EN 61000-4-5:2005 (AC/DC Line to Line: ±1 kV, AC/DC Line to Earth: ±2 kV)
	Immunity to conducted disturbances, Induced by radio-frequency field: EN61000-4-6:2008 (0.15 – 80 MHz with 1 kHz AM 80% Modulation: 3 V/m)
	Power frequency magnetic field immunity test according to EN 61000-4-8:2009 (1 A/m at frequency 50 Hz)
	Voltage dips, short interruptions and voltage variations immunity test according to EN 61000-4- 11:2004 (>95% Reduction @10 ms, 30% Reduction @500 ms, >95% Reduction @5000 ms)
LVD:	EN 60950-1:2006

Safety Compliance

This product complies with and conforms to the following international Product Safety standards as applicable:

- Safety of Information Technology Equipment, IEC(EN) 60950-1, including all relevant national deviations as listed in Compliance with IEC for Electrical Equipment (IECEE)
- Safety of Information Technology Equipment, CAN/CSA-C22.2 No. 60950-1/UL 60950-1

Power Cord Safety

WARNING: Installation and removal of the unit must be carried out by qualified personnel only.

Please read the following safety information carefully before installing the switch:

- The unit must be connected to an earthed (grounded) outlet to comply with international safety standards.
- Do not connect the unit to an A.C. outlet (power supply) without an earth (ground) connection.
- The appliance coupler (the connector to the unit and not the wall plug) must have a configuration for mating with an EN 60320/IEC 320 appliance inlet.
- The socket outlet must be near to the unit and easily accessible. You can only remove power from the unit by disconnecting the power cord from the outlet.
- This unit operates under SELV (Safety Extra Low Voltage) conditions according to IEC 60950. The conditions are only maintained if the equipment to which it is connected also operates under SELV conditions.

France and Peru only

This unit cannot be powered from IT[1] supplies. If your supplies are of IT type, this unit must be powered by 230 V (2P+T) via an isolation transformer ratio 1:1, with the secondary connection point labelled Neutral, connected directly to earth (ground).

Important! Before making connections, make sure you have the correct cord set. Check it (read the label on the cable) against the following:

Power Cord Set	
U.S.A. and Canada	The cord set must be UL-approved and CSA certified.
	The minimum specifications for the flexible cord are: - No. 18 AWG - not longer than 2 meters, or 16 AWG. - Type SV or SJ - 3-conductor
	The cord set must have a rated current capacity of at least 10 A
	The attachment plug must be an earth-grounding type with NEMA 5-15P (15 A, 125 V) configuration.
Denmark	The supply plug must comply with Section 107-2-D1, Standard DK2-1a or DK2-5a.
Switzerland	The supply plug must comply with SEV/ASE 1011.
U.K.	The supply plug must comply with BS1363 (3-pin 13 A) and be fitted with a 5 A fuse which complies with BS1362.
	The mains cord must comply with IEC 60227 (designation 60227 IEC 52).
Europe	The supply plug must comply with CEE7/7 ("SCHUKO").
	The mains cord must comply with IEC 60227 (designation 60227 IEC 52).
	IEC-320 receptacle.

Veuillez lire à fond l'information de la sécurité suivante avant d'installer le Switch:

AVERTISSEMENT: L'installation et la dépose de ce groupe doivent être confiés à un personnel qualifié.

- Ne branchez pas votre appareil sur une prise secteur (alimentation électrique) lorsqu'il n'y a pas de connexion de mise à la terre (mise à la masse).
- Vous devez raccorder ce groupe à une sortie mise à la terre (mise à la masse) afin de respecter les normes internationales de sécurité.
- Le coupleur d'appareil (le connecteur du groupe et non pas la prise murale) doit respecter une configuration qui permet un branchement sur une entrée d'appareil EN 60320/IEC 320.

1. Impédance à la terre

- La prise secteur doit se trouver à proximité de l'appareil et son accès doit être facile. Vous ne pouvez mettre l'appareil hors circuit qu'en débranchant son cordon électrique au niveau de cette prise.
- L'appareil fonctionne à une tension extrêmement basse de sécurité qui est conforme à la norme IEC 60950. Ces conditions ne sont maintenues que si l'équipement auquel il est raccordé fonctionne dans les mêmes conditions.

France et Pérou uniquement:

Ce groupe ne peut pas être alimenté par un dispositif à impédance à la terre. Si vos alimentations sont du type impédance à la terre, ce groupe doit être alimenté par une tension de 230 V (2 P+T) par le biais d'un transformateur d'isolement à rapport 1:1, avec un point secondaire de connexion portant l'appellation Neutre et avec raccordement direct à la terre (masse).

Cordon électrique - Il doit être agréé dans le pays d'utilisation	
Etats-Unis et Canada:	Le cordon doit avoir reçu l'homologation des UL et un certificat de la CSA.
	Les spécifications minimales pour un cable flexible sont AWG No. 18, ouAWG No. 16 pour un cable de longueur inférieure à 2 mètres. - type SV ou SJ - 3 conducteurs
	Le cordon doit être en mesure d'acheminer un courant nominal d'au moins 10 A.
	La prise femelle de branchement doit être du type à mise à la terre (mise à la masse) et respecter la configuration NEMA 5-15P (15 A, 125 V).
Danemark:	La prise mâle d'alimentation doit respecter la section 107-2 D1 de la norme DK2 1a ou DK2 5a.
Suisse:	La prise mâle d'alimentation doit respecter la norme SEV/ASE 1011.
Europe	La prise secteur doit être conforme aux normes CEE 7/7 ("SCHUKO") Le cordon d'alimentation doit être conforme à la norme IEC 60227 (IEC 60227 désignation 52)

WARNING: Die Installation und der Ausbau des Geräts darf nur durch Fachpersonal erfolgen.

Bitte unbedingt vor dem Einbauen des Switches die folgenden Sicherheitsanweisungen durchlesen:

- Das Gerät sollte nicht an eine ungeerdete Wechselstromsteckdose angeschlossen werden.
- Das Gerät muß an eine geerdete Steckdose angeschlossen werden, welche die internationalen Sicherheitsnormen erfüllt.
- Der Gerätestecker (der Anschluß an das Gerät, nicht der Wandsteckdosenstecker) muß einen gemäß EN 60320/IEC 320 konfigurierten Geräteeingang haben.

- Die Netzsteckdose muß in der Nähe des Geräts und leicht zugänglich sein. Die Stromversorgung des Geräts kann nur durch Herausziehen des Gerätenetzkabels aus der Netzsteckdose unterbrochen werden.
- **Der Betrieb dieses Geräts erfolgt unter den SELV-Bedingungen (Sicherheitskleinstspannung) gemäß IEC 60950. Diese Bedingungen sind nur gegeben, wenn auch die an das Gerät angeschlossenen Geräte unter SELV-Bedingungen betrieben werden.**

Stromkabel. Dies muss von dem Land, in dem es benutzt wird geprüft werden:	
Schweiz	Dieser Stromstecker muß die SEV/ASE 1011Bestimmungen einhalten.
Europe	Das Netzkabel muss mit IEC 60227 (IEC 60227 entsprechen Bezeichnung 52) Der Netzstecker muß die Norm CEE 7/7 erfüllen ("SCHUKO").

2-6 Warnings and Cautionary Messages

WARNING: This product does not contain any serviceable user parts.

WARNING: Installation and removal of the unit must be carried out by qualified personnel only.

WARNING: When connecting this device to a power outlet, connect the field ground lead on the tri-pole power plug to a valid earth ground line to prevent electrical hazards.

WARNING: This switch uses lasers to transmit signals over fiber optic cable. The lasers are compliant with the requirements of a Class 1 Laser Product and are inherently eye safe in normal operation. However, you should never look directly at a transmit port when it is powered on.

NOTE: Wear an anti-static wrist strap or take other suitable measures to prevent electrostatic discharge when handling this equipment.

NOTE: Do not plug a phone jack connector in the RJ-45 port. This may damage this device.

NOTE: Use only twisted-pair cables with RJ-45 connectors that conform to FCC standards.

Environmental Statements

The manufacturer of this product endeavours to sustain an environmentally-friendly policy throughout the entire production process. This is achieved though the following means:

- Adherence to national legislation and regulations on environmental production standards.
- Conservation of operational resources.
- Waste reduction and safe disposal of all harmful un-recyclable by-products.
- Recycling of all reusable waste content.

- Design of products to maximize recyclables at the end of the product's life span.
- Continual monitoring of safety standards.

End of Product Life Span

This product is manufactured in such a way as to allow for the recovery and disposal of all included electrical components once the product has reached the end of its life.

Manufacturing Materials

There are no hazardous nor ozone-depleting materials in this product.

Chapter 3
Initial Configuration

This chapter includes information on connecting to the switch and basic configuration procedures.

3-1 Connecting to the Switch

The switch includes a built-in network management agent. The agent offers a variety of management options, including SNMP, RMON and a web-based interface. A PC may also be connected directly to the switch for configuration and monitoring via a command line interface (CLI).

NOTE: An IPv4 address for this switch is obtained via DHCP by default. To change this address, see "Setting an IP Address" on page 3-5.

Configuration Options

The switch's HTTP web agent allows you to configure switch parameters, monitor port connections, and display statistics using a standard web browser such as Internet Explorer 5.x or above, Netscape 6.2 or above, and Mozilla Firefox 2.0.0.0 or above. The switch's web management interface can be accessed from any computer attached to the network.

The CLI program can be accessed by a direct connection to the RS-232 serial console port on the switch, or remotely by a Telnet connection over the network.

The switch's management agent also supports SNMP (Simple Network Management Protocol). This SNMP agent permits the switch to be managed from any system in the network using network management software.

The switch's web interface, console interface, and SNMP agent allow you to perform the following management functions:

- Set user names and passwords
- Set an IP interface for a management VLAN
- Configure SNMP parameters
- Enable/disable any port
- Set the speed/duplex mode for any port
- Configure the bandwidth of any port by limiting input or output rates
- Control port access through IEEE 802.1X security or static address filtering

- Filter packets using Access Control Lists (ACLs)
- Configure up to 256 IEEE 802.1Q VLANs
- Enable GVRP automatic VLAN registration
- Configure IGMP multicast filtering
- Upload and download system firmware or configuration files via HTTP (using the web interface) or FTP/TFTP (using the command line or web interface)
- Configure Spanning Tree parameters
- Configure Class of Service (CoS) priority queuing
- Configure static or LACP trunks (up to 12)
- Enable port mirroring
- Set storm control on any port for excessive broadcast, multicast, or unknown unicast traffic
- Display system information and statistics

Required Connections

The switch provides an RS-232 serial port that enables a connection to a PC or terminal for monitoring and configuring the switch. A null-modem console cable is provided with the switch.

Attach a VT100-compatible terminal, or a PC running a terminal emulation program to the switch. You can use the console cable provided with this package, or use a null-modem cable that complies with the wiring assignments shown in the Installation Guide.

To connect a terminal to the console port, complete the following steps:

1. Connect the console cable to the serial port on a terminal, or a PC running terminal emulation software, and tighten the captive retaining screws on the DB-9 connector.
2. Connect the other end of the cable to the RS-232 serial port on the switch.
3. Make sure the terminal emulation software is set as follows:
    - Select the appropriate serial port (COM port 1 or COM port 2).
    - Set the baud rate to 9600 bps.
    - Set the data format to 8 data bits, 1 stop bit, and no parity.
    - Set flow control to none.
    - Set the emulation mode to VT100.
    - When using HyperTerminal, select Terminal keys, not Windows keys.

NOTE: Once you have set up the terminal correctly, the console login screen will be displayed.

For a description of how to use the CLI, see Chapter 19: "Using the Command Line Interface" on page 19-1. For a list of all the CLI commands and detailed information on using the CLI, refer to Section 19-3: "CLI Command Groups" on page 19-11.

Remote Connections

Prior to accessing the switch's onboard agent via a network connection, you must first configure it with a valid IP address, subnet mask, and default gateway using a console connection, or DHCP protocol.

An IPv4 address for this switch is obtained via DHCP by default. To manually configure this address or enable dynamic address assignment via DHCP, see "Setting an IP Address" on page 3-5.

NOTE: This switch supports four Telnet sessions or four SSH sessions.

After configuring the switch's IP parameters, you can access the onboard configuration program from anywhere within the attached network. The onboard configuration program can be accessed using Telnet from any computer attached to the network. The switch can also be managed by any computer using a web browser (Internet Explorer 5.0 or above, Netscape 6.2 or above, or Mozilla Firefox 2.0.0.0 or above), or from a network computer using SNMP network management software.

The onboard program only provides access to basic configuration functions. To access the full range of SNMP management functions, you must use SNMP-based network management software.

3-2 Basic Configuration

Console Connection

The CLI program provides two different command levels — normal access level (Normal Exec) and privileged access level (Privileged Exec). The commands available at the Normal Exec level are a limited subset of those available at the Privileged Exec level and allow you to only display information and use basic utilities. To fully configure the switch parameters, you must access the CLI at the Privileged Exec level.

Access to both CLI levels are controlled by user names and passwords. The switch has a default user name and password for each level. To log into the CLI at the Privileged Exec level using the default user name and password, perform these steps:

1. To initiate your console connection, press <Enter>. The "User Access Verification" procedure starts.
2. At the User Name prompt, enter "admin."
3. At the Password prompt, also enter "admin." (The password characters are not displayed on the console screen.)
4. The session is opened and the CLI displays the "SSE-G2252#" prompt indicating you have access at the Privileged Exec level.

Setting Passwords

If this is your first time to log into the CLI program, you should define new passwords for both default user names using the "username" command, record them and put them in a safe place.

Passwords can consist of up to 32 alphanumeric characters and are case sensitive. To prevent unauthorized access to the switch, set the passwords as follows:

1. Open the console interface with the default user name and password "ADMIN" to access the Privileged Exec level.
2. Type "configure" and press <Enter>.
3. Type "username guest password 0 *password*," for the Normal Exec level, where *password* is your new password. Press <Enter>.
4. Type "username admin password 0 *password*," for the Privileged Exec level, where *password* is your new password. Press <Enter>.

```
Username: ADMIN
Password:

 CLI session with the SSE-G2252* is opened.
 To end the CLI session, enter [Exit].

SSE-G2252#configure
SSE-G2252(config)#username guest password 0 [password]
SSE-G2252(config)#username admin password 0 [password]
SSE-G2252(config)#
```

NOTE: This manual covers the SSE-G2252 and SSE-G2252P Gigabit Ethernet switches. Other than the support for PoE on the SSE-G2252P, there are no other significant differences. Therefore nearly all of the screen display examples are based on the SSE-G2252.

Setting an IP Address

You must establish IP address information for the switch to obtain management access through the network. This can be done in either of the following ways:

- **Manual** — You have to input the information, including IP address and subnet mask. If your management station is not in the same IP subnet as the switch, you will also need to specify the default gateway router.
- Dynamic — The switch can send IPv4 configuration requests to BOOTP or DHCP address allocation servers on the network, or can automatically generate a unique IPv6 host address based on the local subnet address prefix received in router advertisement messages. as described in "Obtaining an IPv6 Address" on page 3-9.

The current software does not support DHCP for IPv6, so an IPv6 global unicast address for use in a network containing more than one subnet can only be manually configured as described in "Assigning an IPv6 Address" on page 3-6.

Manual Configuration

You can manually assign an IP address to the switch. You may also need to specify a default gateway that resides between this device and management stations that exist on another network segment. Valid IPv4 addresses consist of four decimal numbers, 0 to 255, separated by periods. Anything outside this format will not be accepted by the CLI program.

NOTE: The default IPv4 address for this switch is set to 192.168.100.102, and the subnet mask to 255.255.255.0.

Assigning an IPv4 Address

Before you can assign an IP address to the switch, you must obtain the following information from your network administrator:

- IP address for the switch
- Network mask for this network
- Default gateway for the network

To assign an IPv4 address to the switch, complete the following steps

1. From the Global Configuration mode prompt, type "interface vlan 1" to access the interface-configuration mode. Press <Enter>.
2. Type "ip address *ip-address netmask*," where "ip-address" is the switch IP address and "netmask" is the network mask for the network. Press <Enter>.
3. Type "exit" to return to the global configuration mode prompt. Press <Enter>.
4. To set the IP address of the default gateway for the network to which the switch belongs, type "ip default-gateway *gateway*," where "gateway" is the IP address of the default gateway. Press <Enter>.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ip address 192.168.1.5 255.255.255.0
SSE-G2252(config-if)#exit
SSE-G2252(config)#ip default-gateway 192.168.1.254
```

Assigning an IPv6 Address

This section describes how to configure a "link local" address for connectivity within the local subnet only, and also how to configure a "global unicast" address, including a network prefix for use on a multi-segment network and the host portion of the address.

An IPv6 prefix or address must be formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used to indicate the appropriate number of zeros required to fill the undefined fields. For detailed information on the other ways to assign IPv6 addresses, see Section 16-4: "Setting the Switch's IP Address (IP Version 6)" on page 16-7.

Link Local Address — All link-local addresses must be configured with a prefix of FE80. Remember that this address type makes the switch accessible over IPv6 for all devices attached to the same local subnet only. Also, if the switch detects that the address you configured conflicts with that in use by another device on the subnet, it will stop using the address in question, and automatically generate a link local address that does not conflict with any other devices on the local subnet.

To configure an IPv6 link local address for the switch, complete the following steps:

1. From the Global Configuration mode prompt, type "interface vlan 1" to access the interface-configuration mode. Press <Enter>.
2. Type "ipv6 address" followed by up to 8 colon-separated 16-bit hexadecimal values for the *ipv6-address* similar to that shown in the example, followed by the "link-local" command parameter. Then press <Enter>.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ipv6 address FE80::260:3EFF:FE11:6700 link-local
SSE-G2252(config-if)#ipv6 enable
SSE-G2252(config-if)#end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::260:3EFF:FE11:6700/64
Global unicast address(es):
```

```
(None)
Joined group address(es):
FF02::1:FF11:6700
FF02::1
IPv6 link MTU is 1500 bytes
ND DAD is enabled, number of DAD attempts: 3.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Address for Multi-segment Network — Before you can assign an IPv6 address to the switch that will be used to connect to a multi-segment network, you must obtain the following information from your network administrator:

- Prefix for this network
- IP address for the switch
- Default gateway for the network

For networks that encompass several different subnets, you must define the full address, including a network prefix and the host address for the switch. You can specify either the full IPv6 address, or the IPv6 address and prefix length. The prefix length for an IPv6 network is the number of bits (from the left) of the prefix that form the network address, and is expressed as a decimal number. For example, all IPv6 addresses that start with the first byte of 73 (hexadecimal) could be expressed as 73:0:0:0:0:0:0:0/8 or 73::/8.

To generate an IPv6 global unicast address for the switch, complete the following steps:

1. From the global configuration mode prompt, type “interface vlan 1” to access the interface-configuration mode. Press <Enter>.
2. From the interface prompt, type “ipv6 address *ipv6-address*” or “ipv6 address *ipv6-address/prefix-length*,” where “prefix-length” indicates the address bits used to form the network portion of the address. (The network address starts from the left of the prefix and should encompass some of the ipv6-address bits.) The remaining bits are assigned to the host interface. Press <Enter>.
3. Type “exit” to return to the global configuration mode prompt. Press <Enter>.
4. To set the IP address of the IPv6 default gateway for the network to which the switch belongs, type “ipv6 default-gateway *gateway*,” where “gateway” is the IPv6 address of the default gateway. Press <Enter>.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ipv6 address 2001:DB8:2222:7272::/64
SSE-G2252(config-if)#exit
SSE-G2252(config)#ipv6 default-gateway 2001:DB8:2222:7272::254
SSE-G2252(config)end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::260:3EFF:FE11:6700/64
Global unicast address(es):
  2001:DB8:2222:7272::/64, subnet is 2001:DB8:2222:7272::/64
Joined group address(es):
```

```
FF02::1:FF00:0
FF02::1:FF11:6700
FF02::1
IPv6 link MTU is 1500 bytes
ND DAD is enabled, number of DAD attempts: 3.
ND retransmit interval is 1000 milliseconds

SSE-G2252#show ipv6 default-gateway
ipv6 default gateway:  2001:DB8:2222:7272::254
SSE-G2252#
```

Dynamic Configuration

Obtaining an IPv4 Address

If you select the "bootp" or "dhcp" option, the system will immediately start broadcasting service requests. IP will be enabled but will not function until a BOOTP or DHCP reply has been received. Requests are broadcast every few minutes using exponential backoff until IP configuration information is obtained from a BOOTP or DHCP server. BOOTP and DHCP values can include the IP address, subnet mask, and default gateway. If the DHCP/BOOTP server is slow to respond, you may need to use the "ip dhcp restart client" command to re-start broadcasting service requests.

Note that the "ip dhcp restart client" command can also be used to start broadcasting service requests for all VLANs configured to obtain address assignments through BOOTP or DHCP. It may be necessary to use this command when DHCP is configured on a VLAN, and the member ports which were previously shut down are now enabled.

If the "bootp" or "dhcp" option is saved to the startup-config file (step 6), then the switch will start broadcasting service requests as soon as it is powered on.

To automatically configure the switch by communicating with BOOTP or DHCP address allocation servers on the network, complete the following steps:

1. From the Global Configuration mode prompt, type "interface vlan 1" to access the interface-configuration mode. Press <Enter>.
2. At the interface-configuration mode prompt, use one of the following commands:
   - To obtain IP settings via DHCP, type "ip address dhcp" and press <Enter>.
   - To obtain IP settings via BOOTP, type "ip address bootp" and press <Enter>.
3. Type "end" to return to the Privileged Exec mode. Press <Enter>.
4. Wait a few minutes, and then check the IP configuration settings by typing the "show ip interface" command. Press <Enter>.
5. Then save your configuration changes by typing "copy running-config startup-config." Enter the startup file name and press <Enter>.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ip address dhcp
SSE-G2252(config-if)#end
SSE-G2252#show ip interface
Vlan 1 is Administrative Up - Link Up
  Address is 00-E0-0C-00-00-FD (via 00-E0-0C-00-00-FD)
```

```
  Index: 1001, MTU: 1500, Bandwidth: 1g
  Address Mode is DHCP
  IP Address: 192.168.0.5 Mask: 255.255.255.0
  Proxy ARP is disabled
SSE-G2252#copy running-config startup-config
Startup configuration file name []: startup
\Write to FLASH Programming.

\Write to FLASH finish.
Success.
```

Obtaining an IPv6 Address

Link Local Address — There are several ways to configure IPv6 addresses. The simplest method is to automatically generate a “link local” address (identified by an address prefix of FE80). This address type makes the switch accessible over IPv6 for all devices attached to the same local subnet.

To generate an IPv6 link local address for the switch, complete the following steps:

1. From the Global Configuration mode prompt, type “interface vlan 1” to access the interface-configuration mode. Press <Enter>.
2. Type “ipv6 enable” and press <Enter>.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ipv6 enable
SSE-G2252(config-if)#end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::2E0:CFF:FE00:FD/64
Global unicast address(es):
(None)
Joined group address(es):
FF02::1:FF00:FD
FF02::1
IPv6 link MTU is 1500 bytes
ND DAD is enabled, number of DAD attempts: 3.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Address for Multi-segment Network — To generate an IPv6 address that can be used in a network containing more than one subnet, the switch can be configured to automatically generate a unique host address based on the local subnet address prefix received in router advertisement messages. (DHCP for IPv6 will also be supported in future software releases.)

To dynamically generate an IPv6 host address for the switch, complete the following steps:

1. From the Global Configuration mode prompt, type “interface vlan 1” to access the interface-configuration mode. Press <Enter>.
2. From the interface prompt, type “ipv6 address autoconfig” and press <Enter>.

3. Type "ipv6 enable" and press <Enter> to enable IPv6 on an interface that has not been configured with an explicit IPv6 address.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ipv6 address autoconfig
Console(config-if)#ipv6 enable
SSE-G2252(config-if)#end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::212:CFFF:FE0B:4600/64
Global unicast address(es):
  2005::212:CFFF:FE0B:4600, subnet is 2005:0:0:0::/64
  3FFE:501:FFFF:100:212:CFFF:FE0B:4600, subnet is 3FFE:501:FFFF:100::/
64
Joined group address(es):
  FF01::1/16
  FF02::1/16
  FF02::1:FF0B:4600/104
MTU is 1500 bytes.
ND DAD is enabled, number of DAD attempts: 1.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Downloading a Configuration File Referenced by a DHCP Server

Information passed on to the switch from a DHCP server may also include a configuration file to be downloaded and the TFTP servers where that file can be accessed. If the Factory Default Configuration file is used to provision the switch at startup, in addition to requesting IP configuration settings from the DHCP server, it will also ask for the name of a bootup configuration file and TFTP servers where that file is stored.

If the switch receives information that allows it to download the remote bootup file, it will save this file to a local buffer, and then restart the provision process.

Note the following DHCP client behavior:

- The bootup configuration file received from a TFTP server is stored on the switch with the original file name. If this file name already exists in the switch, the file is overwritten.
- If the name of the bootup configuration file is the same as the Factory Default Configuration file, the download procedure will be terminated, and the switch will not send any further DHCP client requests.
- If the switch fails to download the bootup configuration file based on information passed by the DHCP server, it will not send any further DHCP client requests.

- If the switch does not receive a DHCP response prior to completing the bootup process, it will continue to send a DHCP client request once a minute. These requests will only be terminated if the switch's address is manually configured, but will resume if the address mode is set back to DHCP.

To successfully transmit a bootup configuration file to the switch the DHCP daemon (using a Linux based system for this example) must be configured with the following information:

- Options 60, 66 and 67 statements can be added to the daemon's configuration file.

Table 3-1. Options 60, 66 and 67 Statements

Option	Statement	
	Keyword	Parameter
60	vendor-class-identifier	a string indicating the vendor class identifier
66	tftp-server-name	a string indicating the tftp server name
67	bootfile-name	a string indicating the bootfile name

- By default, DHCP option 66/67 parameters are not carried in a DHCP server reply. To ask for a DHCP reply with option 66/67 information, the DHCP client request sent by this switch includes a "parameter request list" asking for this information. Besides, the client request also includes a "vendor class identifier" that allows the DHCP server to identify the device, and select the appropriate configuration file for download. This information is included in Option 55 and 124.

Table 3-2. Options 55 and 124 Statements

Option	Statement	
	Keyword	Parameter
55	dhcp-parameter-request-list	a list of parameters, separated by ','
124	vendor-class-identifier	a string indicating the vendor class identifier

The following configuration examples are provided for a Linux-based DHCP daemon (dhcpd.conf file). The server will reply with Options 66/67 encapsulated in Option 43. Note that in the "Vendor class one" section, if the DHCP request packet's vendor class identifier matches that specified in this file, the server will send Option 43 encapsulating Option 66 and 67 in the DHCP reply packet. In the "Vendor class two" section, the server will always send Option 66 and 67 to tell switch to download the "test2" configuration file from server 192.168.255.101.

```
ddns-update-style ad-hoc;

default-lease-time 600;
max-lease-time 7200;

log-facility local7;

server-name "Server1";
Server-identifier 192.168.255.250;
#option 43 with encapsulated option 66, 67
```

```
 option space dynamicProvision code width 1 length 1 hash size 2;
 option dynamicProvision.tftp-server-name code 66 = text;
 option dynamicProvision.bootfile-name code 67 = text;

subnet 192.168.255.0 netmask 255.255.255.0 {
  range 192.168.255.160 192.168.255.200;
  option routers 192.168.255.101;
  option tftp-server-name "192.168.255.100";#Default Option 66
  option bootfile-name "bootfile";           #Default Option 67
}

class "Option66,67_1" { #DHCP Option 60 Vendor class one
 match if option vendor-class-identifier = "SM_SSE-G2252_Op.bix";
#option 43
 option vendor-class-information code 43 = encapsulate dynamicProvision;
#option 66 encapsulated in option 43
 option vendor-class-information.tftp-server-name "192.168.255.100";
#option 67 encapsulated in option 43
    option vendor-class-information.bootfile-name "test1"
}

class "Option66,67_2" {#DHCP Option 60 Vendor class two
  match if option vendor-class-identifier = "SM_SSE-G2252_Op.bix";
  option tftp-server-name "192.168.255.101";
  option bootfile-name "test2";
}
```

NOTE: Use "SM_SSE-G2252_Op.bix" for the vendor-class-identifier in the dhcpd.conf file.

Enabling SNMP Management Access

The switch can be configured to accept management commands from Simple Network Management Protocol (SNMP) applications. You can configure the switch to respond to SNMP requests or generate SNMP traps.

When SNMP management stations send requests to the switch (either to return information or to set a parameter), the switch provides the requested data or sets the specified parameter. The switch can also be configured to send information to SNMP managers (without being requested by the managers) through trap messages, which inform the manager that certain events have occurred.

The switch includes an SNMP agent that supports SNMP version 1, 2c, and 3 clients. To provide management access for version 1 or 2c clients, you must specify a community string. The switch provides a default MIB View (i.e., an SNMPv3 construct) for the default "public" community string that provides read access to the entire MIB tree, and a default view for the "private" community string that provides read/write access to the entire MIB tree. However, you may assign new views to version 1 or 2c community strings that suit your specific security requirements (see "Setting SNMPv3 Views" on page 15-35).

Community Strings (for SNMP version 1 and 2c Clients)

Community strings are used to control management access to SNMP version 1 and 2c stations, as well as to authorize SNMP stations to receive trap messages from the switch. You therefore need to assign community strings to specified users, and set the access level.

The default strings are:

- **public** - with read-only access. Authorized management stations are only able to retrieve MIB objects.
- **private** - with read/write access. Authorized management stations are able to both retrieve and modify MIB objects.

To prevent unauthorized access to the switch from SNMP version 1 or 2c clients, it is recommended that you change the default community strings.

To configure a community string, complete the following steps:

1. From the Privileged Exec level global configuration mode prompt, type "snmp-server community *string mode*," where "string" is the community access string and "mode" is **rw** (read/write) or **ro** (read only). Press <Enter>. (Note that the default mode is read only.)
2. To remove an existing string, simply type "no snmp-server community *string*," where "string" is the community access string to remove. Press <Enter>.

```
SSE-G2252(config)#snmp-server community admin rw
SSE-G2252(config)#snmp-server community private
SSE-G2252(config)#
```

NOTE: If you do not intend to support access to SNMP version 1 and 2c clients, we recommend that you delete both of the default community strings. If there are no community strings, then SNMP management access from SNMP v1 and v2c clients is disabled.

Trap Receivers

You can also specify SNMP stations that are to receive traps from the switch. To configure a trap receiver, use the "snmp-server host" command. From the Privileged Exec level global configuration mode prompt, type:

"snmp-server host *host-address community-string* [version {1 | 2c | 3 {auth | noauth | priv}}]"

where "host-address" is the IP address for the trap receiver, "community-string" specifies access rights for a version 1/2c host, or is the user name of a version 3 host, "version" indicates the SNMP client version, and "auth | noauth | priv" means that authentication, no authentication, or authentication and privacy is used for v3 clients. Then press <Enter>. For a more detailed description of these parameters, see "snmp-server host" on page 22-8. The following example creates a trap host for each type of SNMP client.

```
SSE-G2252(config)#snmp-server host 10.1.19.23 batman
```

```
SSE-G2252(config)#snmp-server host 10.1.19.98 robin version 2c
SSE-G2252(config)#snmp-server host 10.1.19.34 barbie version 3 auth
SSE-G2252(config)#
```

Configuring Access for SNMP Version 3 Clients

To configure management access for SNMPv3 clients, you need to first create a view that defines the portions of MIB that the client can read or write, assign the view to a group, and then assign the user to a group. The following example creates one view called "mib-2" that includes the entire MIB-2 tree branch, and then another view that includes the IEEE 802.1d bridge MIB. It assigns these respective read and read/write views to a group call "r&d" and specifies group authentication via MD5 or SHA. In the last step, it assigns a v3 user to this group, indicating that MD5 will be used for authentication, provides the password "greenpeace" for authentication, and the password "einstien" for encryption.

```
SSE-G2252(config)#snmp-server view mib-2 1.3.6.1.2.1 included
SSE-G2252(config)#snmp-server view 802.1d 1.3.6.1.2.1.17 included
SSE-G2252(config)#snmp-server group r&d v3 auth mib-2 802.1d
SSE-G2252(config)#snmp-server user steve group r&d v3 auth md5
greenpeace priv des56 einstien
SSE-G2252(config)#
```

For a more detailed explanation on how to configure the switch for access from SNMP v3 clients, refer to the specific CLI commands for SNMP in Chapter 22: "SNMP Commands" on page 22-1.

3-3 Managing System Files

The switch's flash memory supports three types of system files that can be managed by the CLI program, web interface, or SNMP. The switch's file system allows files to be uploaded and downloaded, copied, deleted, and set as a start-up file.

The types of files are:

- **Configuration** — This file type stores system configuration information and is created when configuration settings are saved. Saved configuration files can be selected as a system start-up file or can be uploaded via FTP/TFTP to a server for backup. The file named "Factory_Default_Config.cfg" contains all the system default settings and cannot be deleted from the system. If the system is booted with the factory default settings, the switch will also create a file named "startup1.cfg" that contains system settings for switch initialization, including information about the unit identifier, and MAC address for the switch. The configuration settings from the factory defaults configuration file are copied to this file, which is then used to boot the switch.
- **Operation Code** — System software that is executed after boot-up, also known as run-time code. This code runs the switch operations and provides the CLI and web management interfaces.
- **Diagnostic Code** — Software that is run during system boot-up, also known as POST (Power On Self-Test).

Due to the size limit of the flash memory, the switch supports only two operation code files. However, you can have as many diagnostic code files and configuration files as available flash memory space allows. The switch has a total of 32 Mbytes of flash memory for system files.

In the system flash memory, one file of each type must be set as the start-up file. During a system boot, the diagnostic and operation code files set as the start-up file are run, and then the start-up configuration file is loaded.

Note that configuration files should be downloaded using a file name that reflects the contents or usage of the file settings. If you download directly to the running-config, the system will reboot, and the settings will have to be copied from the running-config to a permanent file.

Saving or Restoring Configuration Settings

Configuration commands only modify the running configuration file and are not saved when the switch is rebooted. To save all your configuration changes in nonvolatile storage, you must copy the running configuration file to the start-up configuration file using the “copy” command.

New startup configuration files must have a name specified. File names on the switch are case-sensitive, can be from 1 to 31 characters, must not contain slashes (\ or /), and the leading letter of the file name must not be a period (.). (Valid characters: A-Z, a-z, 0-9, “.”, “-”, “_”)

There can be more than one user-defined configuration file saved in the switch’s flash memory, but only one is designated as the “startup” file that is loaded when the switch boots. The **copy running-config startup-config** command always sets the new file as the startup file. To select a previously saved configuration file, use the **boot system config:**<*filename*> command.

The maximum number of saved configuration files depends on available flash memory. The amount of available flash memory can be checked by using the **dir** command.

To save the current configuration settings, enter the following command:

1. From the Privileged Exec mode prompt, type “copy running-config startup-config” and press <Enter>.
2. Enter the name of the start-up file. Press <Enter>.

```
SSE-G2252#copy running-config startup-config
Startup configuration file name []: startup
\Write to FLASH Programming.

\Write to FLASH finish.
Success.

SSE-G2252#
```

To restore configuration settings from a backup server, enter the following command:

1. From the Privileged Exec mode prompt, type "copy tftp startup-config" and press <Enter>.
2. Enter the address of the TFTP server. Press <Enter>.
3. Enter the name of the startup file stored on the server. Press <Enter>.
4. Enter the name for the startup file on the switch. Press <Enter>.

```
SSE-G2252#copy file startup-config
SSE-G2252#copy tftp startup-config
TFTP server IP address: 192.168.0.4
Source configuration file name: startup-rd.cfg
Startup configuration file name [startup1.cfg]:

Success.
SSE-G2252#
```

Chapter 4
Using the Web Interface

This switch provides an embedded HTTP web agent. Using a web browser you can configure the switch and view statistics to monitor network activity. The web agent can be accessed by any computer on the network using a standard web browser (Internet Explorer 5.0 or above, Netscape 6.2 or above, or Mozilla Firefox 2.0.0.0 or above).

NOTE: You can also use the Command Line Interface (CLI) to manage the switch over a serial connection to the console port or via Telnet. For more information on using the CLI, refer to Chapter 19: "Using the Command Line Interface" on page 19-1.

4-1 Connecting to the Web Interface

Prior to accessing the switch from a web browser, be sure you have first performed the following tasks:

1. Configure the switch with a valid IP address, subnet mask, and default gateway using an out-of-band serial connection, BOOTP or DHCP protocol. (See "Setting an IP Address" on page 3-5.)
2. If you are using IE9.0, please enable "Compatibility View", (click on the TOOLS menu and then click the COMPATIBILITY VIEW option).
3. Set user names and passwords using an out-of-band serial connection. Access to the web agent is controlled by the same user names and passwords as the onboard configuration program. (See "Setting Passwords" on page 3-4.)
4. After you enter a user name and password, you will have access to the system configuration program.

NOTE: You are allowed three attempts to enter the correct password; on the third failed attempt the current connection is terminated.

NOTE: If you log into the web interface as guest (Normal Exec level), you can view the configuration settings or change the guest password. If you log in as “admin” (Privileged Exec level), you can change the settings on any page.

NOTE: If the path between your management station and this switch does not pass through any device that uses the Spanning Tree Algorithm, then you can set the switch port attached to your management station to fast forwarding (i.e., enable Admin Edge Port) to improve the switch’s response time to management commands issued through the web interface. See Section 9-4: "Configuring Interface Settings for STA" on page 9-12 for details.

NOTE: Users are automatically logged off of the HTTP server or HTTPS server if no input is detected for 600 seconds.

NOTE: Connection to the web interface is not supported for HTTPS using an IPv6 link local address.

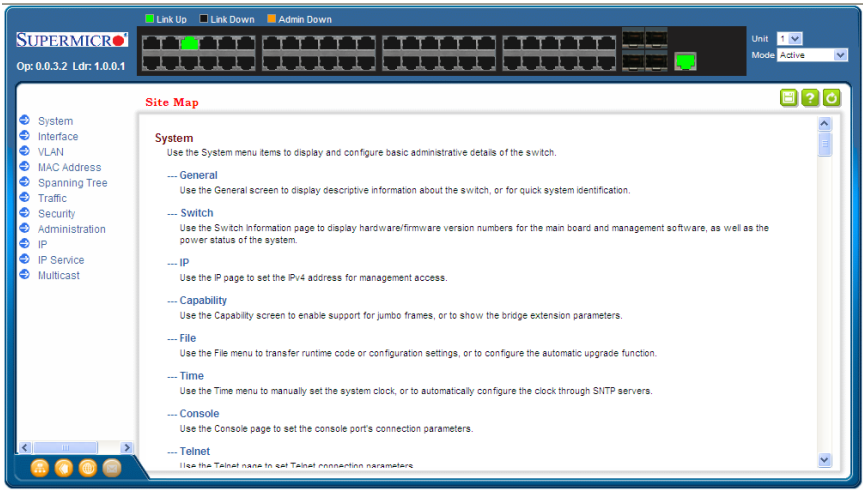
4-2 Navigating the Web Browser Interface

To access the web-browser interface you must first enter a user name and password. The administrator has Read/Write access to all configuration parameters and statistics. The default user name and password for the administrator is "admin."

Home Page

When your web browser connects with the switch's web agent, the home page is displayed as shown below. The home page displays the Main Menu on the left side of the screen and System Information on the right side. The Main Menu links are used to navigate to other menus, and display configuration parameters and statistics.

Figure 4-1. Home Page


Link Up
Link Down
Admin Down
SUPERMICRO
Op: 0.0.3.2 Ldr: 1.0.0.1
Unit 1
Mode Active
Site Map
System
Interface
VLAN
MAC Address
Spanning Tree
Traffic
Security
Administration
IP
IP Service
Multicast
System
Use the System menu items to display and configure basic administrative details of the switch.
--- General
Use the General screen to display descriptive information about the switch, or for quick system identification.
--- Switch
Use the Switch information page to display hardware/firmware version numbers for the main board and management software, as well as the power status of the system.
--- IP
Use the IP page to set the IPv4 address for management access.
--- Capability
Use the Capability screen to enable support for jumbo frames, or to show the bridge extension parameters.
--- File
Use the File menu to transfer runtime code or configuration settings, or to configure the automatic upgrade function.
--- Time
Use the Time menu to manually set the system clock, or to automatically configure the clock through SNTP servers.
--- Console
Use the Console page to set the console port's connection parameters.
--- Telnet

NOTE: This manual covers the SSE-G2252 and SSE-G2252P Gigabit Ethernet switches. Other than the support for PoE on the SSE-G2252P, there are no other significant differences. Therefore nearly all of the screen display examples are based on the SSE-G2252. The panel graphics for both switches are shown on the following page.

Configuration Options

Configurable parameters have a dialog box or a drop-down list. Once a configuration change has been made on a page, be sure to click on the Apply button to confirm the new setting. The following table summarizes the web page configuration buttons.

Table 4-1. Web Page Configuration Buttons

Button	Action
Apply	Sets specified values to the system.
Revert	Cancels specified values and restores current values prior to pressing “Apply.”
	Save current configuration settings.
	Displays help for the selected page.
	Refreshes the current page.
	Displays the site map.
	Logs out of the management interface.
	Links to the manufacture’s web site.
	Sends mail to the manufacturer.

NOTE: To ensure proper screen refresh, be sure that Internet Explorer 5.x is configured as follows: Under the menu “Tools / Internet Options / General / Temporary Internet Files / Settings,” the setting for item “Check for newer versions of stored pages” should be “Every visit to the page.”

NOTE: When using Internet Explorer 5.0, you may have to manually refresh the screen after making configuration changes by pressing the browser’s refresh button.

Panel Display

The web agent displays an image of the switch's ports. The Mode can be set to display different information for the ports, including Active (i.e., up or down), Duplex (i.e., half or full duplex), or Flow Control (i.e., with or without flow control).

Figure 4-2. Front Panel Indicators

SSE-G2252

SSE-G2252P

Showing Status Information

There are various web pages which display configuration settings or the status of specified processes. Many of these pages will not display any information unless the switch is properly configured, and in some cases the interface to which a command applies is up.

For example, if a static router port is configured, the corresponding information page will not display any information unless IGMP snooping is first enabled, and the link for the static router port is up.

Figure 4-3. Displaying Configuration Settings or Status Information 1

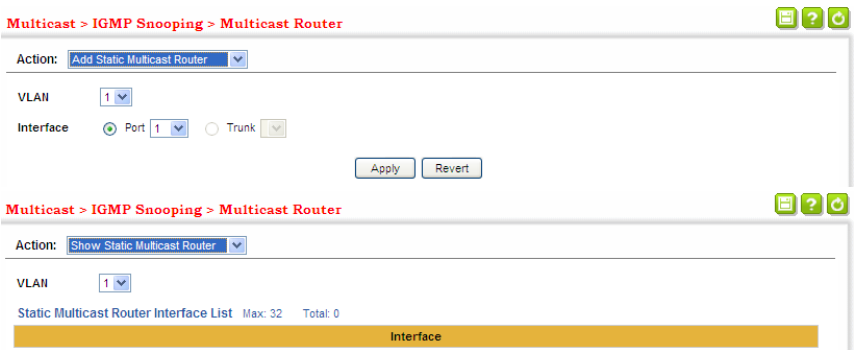
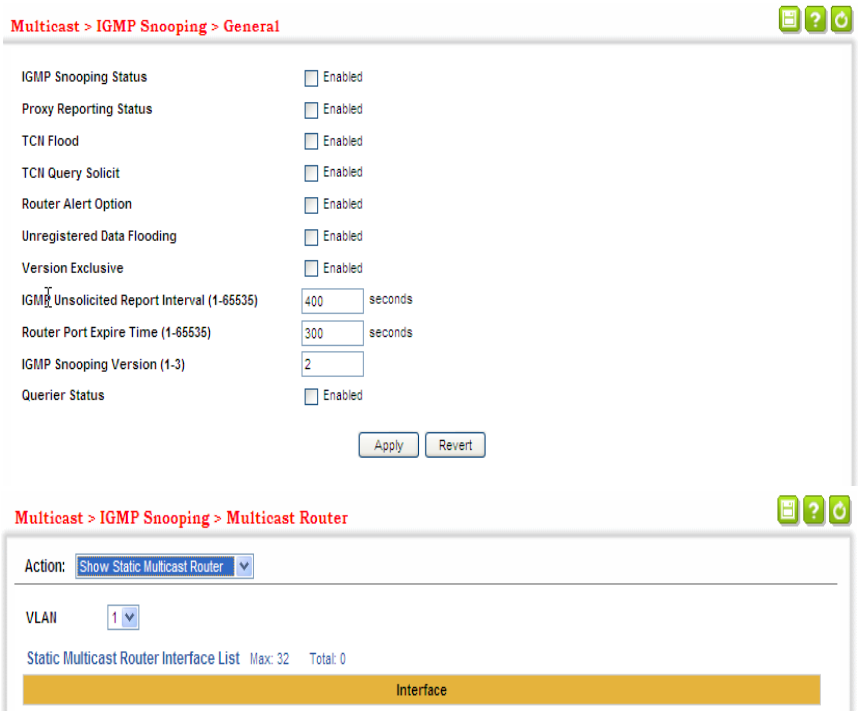

Multicast > IGMP Snooping > Multicast Router
Action: Add Static Multicast Router
VLAN 1
Interface Port 1 Trunk
Apply
Revert
Multicast > IGMP Snooping > Multicast Router
Action: Show Static Multicast Router
VLAN 1
Static Multicast Router Interface List Max: 32 Total: 0
Interface

Figure 4-4. Displaying Configuration Settings or Status Information 2



Main Menu

Using the onboard web agent, you can define system parameters, manage and control the switch, and all its ports, or monitor network conditions. The following table briefly describes the selections available from this program.

Table 4-2. Switch Main Menu

Menu	Description
System	
General	Provides basic system description
Switch	Shows the number of ports, hardware version, power status, and firmware version numbers
IP	Sets the IPv4 address for management access
Capability	Enables support for jumbo frames; shows the bridge extension parameters

Table 4-2. Switch Main Menu (Continued)

Menu	Description
File	
Copy	Allows the transfer and copying files
Set Startup	Sets the startup file
Show	Shows the files stored in flash memory; allows deletion of files
Automatic Operation Code Upgrade	Automatically upgrades operation code if a newer version is found on the server
Time	
Configure General	
Manually	Manually sets the current time
SNTP	Configures SNTP polling interval
Configure Time Server	Configures a list of SNTP servers
Configure Time Zone	Sets the local time zone for the system clock
Console	Sets console port connection parameters
Telnet	Sets Telnet connection parameters
CPU Utilization	Displays information on CPU utilization
Memory Status	Shows memory utilization parameters
Reload	Restarts the switch immediately, at a specified time, after a specified delay, or at a periodic interval
Interface	
Port	
General	
Configure by Port List	Configures connection settings per port
Configure by Port Range	Configures connection settings for a range of ports
Show Information	Displays port connection status
Mirror	
Add	Sets the source and target ports for mirroring
Show	Shows the configured mirror sessions
Statistics	Shows Interface, Etherlike, and RMON port statistics
Chart	Shows Interface, Etherlike, and RMON port statistics
Cable Test	Performs cable diagnostics for selected port to diagnose any cable faults (short, open etc.) and report the cable length
Trunk	
Static	
Configure Trunk	Creates a trunk, specifying port members

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Configure General	
Configure	Configures trunk connection settings
Show Information	Displays trunk connection settings
Dynamic	
Configure Aggregator	Configures administration key for specific LACP groups
Configure Aggregation Port	
Configure	
General	Allows ports to dynamically join trunks
Actor	Configures parameters for link aggregation group members on the local side
Partner	Configures parameters for link aggregation group members on the remote side
Show Information	
Counters	Displays statistics for LACP protocol messages
Internal	Displays configuration settings and operational state for the local side of a link aggregation
Neighbors	Displays configuration settings and operational state for the remote side of a link aggregation
Configure Trunk	
Show	Displays trunk connection settings
Configure	Configures trunk connection settings
Show Member	Show port members of dynamic trunks
Mirror	
Add	Sets the source trunks and target port for mirroring
Show	Shows the configured mirror sessions
Statistics	Shows Interface, Etherlike, and RMON port statistics
Chart	Shows Interface, Etherlike, and RMON port statistics
Green Ethernet	Adjusts the power provided to ports based on the length of the cable used to connect to other devices
RSPAN	Mirrors traffic from remote switches for analysis at a destination port on the local switch
Traffic Segmentation	
Configure Global	Enables traffic segmentation globally
Configure Session	Configures the uplink and down-link ports for a segmented group of ports

Table 4-2. Switch Main Menu (Continued)

Menu	Description
VLAN Trunking	Allows unknown VLAN groups to pass through the specified interface
VLAN	Virtual LAN
Static	
Configure VLAN	Configures VLAN groups, administrative status, and remote type
Modify VLAN and Member Ports	Configures group name, status, and member attributes
Edit Member by Interface	Specifies VLAN attributes per interface
Edit Member by Interface Range	Specifies VLAN attributes per interface range
Dynamic	
Configure General	Enables GVRP VLAN registration protocol globally
Configure Interface	Configures GVRP status and timers per interface
Show Dynamic VLAN	
Show VLAN	Shows the VLANs this switch has joined through GVRP
Show VLAN Member	Shows the interfaces assigned to a VLAN through GVRP
Configure VLAN	
Add	Creates primary or community VLANs
Show	Display configured primary and community VLANs
Add Community VLAN	Associates a community VLAN with a primary VLAN
Show Community VLAN	Shows the community VLANs associated with a primary VLAN
Configure Interface	Sets the private VLAN interface type, and associates the interfaces with a private VLAN
Tunnel	IEEE 802.1Q (QinQ) Tunneling
Configure Global	Sets tunnel mode for the switch
Configure Interface	Sets the tunnel mode for any participating interface
Protocol	
Configure Protocol	
Add	Creates a protocol group, specifying supported protocols
Show	Shows configured protocol groups
Configure Interface	
Add	Maps a protocol group to a VLAN
Show	Shows the protocol groups mapped to each VLAN
IP Subnet	
Add	Maps IP subnet traffic to a VLAN
Show	Shows IP subnet to VLAN mapping

Table 4-2. Switch Main Menu (Continued)

Menu	Description
MAC-Based	
Add	Maps traffic with specified source MAC address to a VLAN
Show	Shows source MAC address to VLAN mapping
Mirror	
Add	Mirrors traffic from one or more source VLANs to a target port
Show	Shows mirror list
MAC Address	
Static	
Add	Configures static entries in the address table
Show	Displays static entries in the address table
Dynamic	
Configure Aging	Sets timeout for dynamically learned entries
Show Dynamic MAC	Displays dynamic entries in the address table
Clear Dynamic MAC	Removes any learned entries from the forwarding database and clears the transmit and receive counts for any static or system configured entries
Mirror	
Add	Mirrors traffic matching a specified source address from any port on the switch to a target port
Show	Shows mirror list
Spanning Tree	
Loopback Detection	Configures Loopback Detection parameters
STA	Spanning Tree Algorithm
Configure Global	
Configure	Configures global bridge settings for STP, RSTP and MSTP
Show Information	Displays STA values used for the bridge
Configure Interface	
Configure	Configures interface settings for STA
Show Information	Displays interface settings for STA
MSTP	Multiple Spanning Tree Algorithm
Configure Global	
Add	Configures initial VLAN and priority for an MST instance
Show	Shows configured MST instances
Modify	Modifies priority for an MST instance
Add Member	Adds VLAN members for an MST instance
Show Member	Adds or deletes VLAN members for an MST instance

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Show Information	Shows global settings for an MST instance
Configure Interface	
Configure	Configures interface settings for an MST instance
Show Information	Displays interface settings for an MST instance
Traffic	
Congestion Control	
Rate Limit	Sets the input and output rate limits for a port
Storm Control	Sets the traffic storm threshold for each interface
Auto Traffic Control	Sets thresholds for broadcast and multicast storms which can be used to trigger configured rate limits or to shut down a port
Configure Global	Sets the time to apply the control response after traffic has exceeded the upper threshold, and the time to release the control response after traffic has fallen beneath the lower threshold
Configure Interface	Sets the storm control mode (broadcast or multicast), the traffic thresholds, the control response, to automatically release a response of rate limiting, or to send related SNMP trap messages
Priority	
Default Priority	Sets the default priority for each port or trunk
Queue	Sets queue mode for the switch; sets the service weight for each queue that will use a weighted or hybrid mode
Trust Mode	Selects IP Precedence, DSCP or CoS priority processing
DSCP to DSCP	
Add	Maps DSCP values in incoming packets to per-hop behavior and drop precedence values for internal priority processing
Show	Shows the DSCP to DSCP mapping list
CoS to DSCP	
Add	Maps CoS/CFI values in incoming packets to per-hop behavior and drop precedence values for priority processing
Show	Shows the CoS to DSCP mapping list
PHB to Queue	
Add	Maps internal per-hop behavior values to hardware queues
Show	Shows the PHB to Queue mapping list
DiffServ	
Configure Class	
Add	Creates a class map for a type of traffic
Show	Shows configured class maps
Modify	Modifies the name of a class map
Add Rule	Configures the criteria used to classify ingress traffic

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Show Rule	Shows the traffic classification rules for a class map
Configure Policy	
Add	Creates a policy map to apply to multiple interfaces
Show	Shows configured policy maps
Modify	Modifies the name of a policy map
Add Rule	Sets the boundary parameters used for monitoring inbound traffic, and the action to take for conforming and non-conforming traffic
Show Rule	Shows the rules used to enforce bandwidth policing for a policy map
Configure Interface	Applies a policy map to an ingress port
VoIP	Voice over IP
Configure Global	Configures auto-detection of VoIP traffic, sets the Voice VLAN, and VLAN aging time
Configure OUI	
Add	Maps the OUI in the source MAC address of ingress packets to the VoIP device manufacturer
Show	Shows the OUI telephony list
Configure Interface	Configures VoIP traffic settings for ports, including the way in which a port is added to the Voice VLAN, filtering of non-VoIP packets, the method of detecting VoIP traffic, and the priority assigned to the voice traffic
Security	
AAA	Authentication, Authorization and Accounting
System Authentication	Configures authentication sequence – local, RADIUS, and TACACS
Server	
Configure Server	Configures RADIUS and TACACS server message exchange settings
Configure Group	
Add	Specifies a group of authentication servers and sets the priority sequence
Show	Shows the authentication server groups and priority sequence
Accounting	Enables accounting of requested services for billing or security purposes
Configure Global	Specifies the interval at which the local accounting service updates information to the accounting server
Configure Method	
Add	Configures accounting for various service types
Show	Shows the accounting settings used for various service types
Configure Service	Sets the accounting method applied to specific interfaces for 802.1X, CLI command privilege levels for the console port, and for Telnet

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Show Information	
Summary	Shows the configured accounting methods, and the methods applied to specific interfaces
Statistics	Shows basic accounting information recorded for user sessions
Authorization	Enables authorization of requested services
Configure Method	
Add	Configures authorization for various service types
Show	Shows the authorization settings used for various service types
Configure Service	Sets the authorization method applied used for the console port, and for Telnet
Show Information	Shows the configured authorization methods, and the methods applied to specific interfaces
User Accounts	
Add	Configures user names, passwords, and access levels
Show	Shows authorized users
Modify	Modifies user attributes
Web Authentication	Allows authentication and access to the network when 802.1X or Network Access authentication are infeasible or impractical
Configure Global	Configures general protocol settings
Configure Interface	Enables Web Authentication for individual ports
Network Access	MAC address-based network access authentication
Configure Global	Enables aging for authenticated MAC addresses, and sets the time period after which a connected MAC address must be reauthenticated
Configure Interface	
General	Enables MAC authentication on a port; sets the maximum number of address that can be authenticated, the guest VLAN, dynamic VLAN and dynamic QoS
Link Detection	Configures detection of changes in link status, and the response (i.e., send trap or shut down port)
Configure MAC Filter	
Add	Specifies MAC addresses exempt from authentication
Show	Shows the list of exempt MAC addresses
Show Information	Shows the authenticated MAC address list
HTTPS	Secure HTTP
Configure Global	Enables HTTPs, and specifies the UDP port to use
Copy Certificate	Replaces the default secure-site certificate
SSH	Secure Shell

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Configure Global	Configures SSH server settings
Configure Host Key	
Generate	Generates the host key pair (public and private)
Show	Displays RSA and DSA host keys; deletes host keys
Configure User Key	
Copy	Imports user public keys from TFTP server
Show	Displays RSA and DSA user keys; deletes user keys
ACL	Access Control Lists
Configure ACL	
Show TCAM	Shows utilization parameters for TCAM
Add	Adds an ACL based on IP or MAC address filtering
Show	Shows the name and type of configured ACLs
Add Rule	Configures packet filtering based on IP or MAC addresses and other packet attributes
Show Rule	Shows the rules specified for an ACL
Configure Interface	Binds a port to the specified ACL and time range
ARP Inspection	
Configure General	Enables inspection globally, configures validation of additional address components, and sets the log rate for packet inspection
Configure VLAN	Enables ARP inspection on specified VLANs
Configure Interface	Sets the trust mode for ports, and sets the rate limit for packet inspection
Show Information	
Show Statistics	Displays statistics on the inspection process
Show Log	Shows the inspection log list
IP Filter	
Add	Sets IP addresses of clients allowed management access via the web, SNMP, and Telnet
Show	Shows the addresses to be allowed management access
Port Security	Configures per port security, including status, response for security breach, and maximum allowed MAC addresses
Port Authentication	IEEE 802.1X
Configure Global	Enables authentication and EAPOL pass-through
Configure Interface	Sets authentication parameters for individual ports
Authenticator	Sets port authenticator settings
Supplicant	Sets port supplicant settings
Show Statistics	Displays protocol statistics for the selected port

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Authenticator	Displays protocol statistics for port authenticator
Supplicant	Displays protocol statistics for port supplicant
IP Source Guard	Filters IP traffic based on static entries in the IP Source Guard table, or dynamic entries in the DHCP Snooping table
Port Configuration	Enables IP source guard and selects filter type per port
Static Binding	
Add	Adds a static addresses to the source-guard binding table
Show	Shows static addresses in the source-guard binding table
Dynamic Binding	Displays the source-guard binding table for a selected interface
Administration	
Log	
System	
Configure Global	Stores error messages in local memory
Show Logs	Shows logged error messages
Remote	Configures the logging of messages to a remote logging process
SMTP	Sends an SMTP client message to a participating server
Configure Server	Configures a list of recipient SMTP servers
Add	Adds a recipient SMTP server
Show	Shows configured SMTP servers
Configure General	Sets SMTP status, e-mail source and destination addresses
LLDP	
Configure Global	Configures global LLDP timing parameters
Configure Interface	
Configure General	Sets the message transmission mode, enables SNMP notification, and sets the LLDP attributes to advertise
Add CA-Type	Specifies the location of the device attached to an interface
Show CA-Type	Shows the location of the device attached to an interface
Modify CA-Type	Modifies the location of the device attached to an interface
Show Local Device Information	
General	Displays general information about the local device
Port/Trunk	Displays information about each interface
Show Remote Device Information	
Port/Trunk	Displays information about a remote device connected to a port on this switch

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Port/Trunk Details	Displays detailed information about a remote device connected to this switch
Show Device Statistics	
General	Displays statistics for all connected remote devices
Port/Trunk	Displays statistics for remote devices on a selected port or trunk
PoE	Power over Ethernet
Configure Global	Displays the power budget for the switch
Configure Interface	Configures port power parameters
SNMP	Simple Network Management Protocol
Configure Global	Enables SNMP agent status, and sets related trap functions
Configure Engine	
Set Engine ID	Sets the SNMP v3 engine ID on this switch
Add Remote Engine	Sets the SNMP v3 engine ID for a remote device
Show Remote Engine	Shows configured engine ID for remote devices
Configure View	
Add View	Adds an SNMP v3 view of the OID MIB
Show View	Shows configured SNMP v3 views
Add OID Subtree	Specifies a part of the subtree for the selected view
Show OID Subtree	Shows the subtrees assigned to each view
Configure Group	
Add	Adds a group with access policies for assigned users
Show	Shows configured groups and access policies
Configure User	
Add Community	Configures community strings and access mode
Show Community	Shows community strings and access mode
Add SNMPv3 Local User	Configures SNMPv3 users on this switch
Show SNMPv3 Local User	Shows SNMPv3 users configured on this switch
Change SNMPv3 Local User Group	Assign a local user to a new group
Add SNMPv3 Remote User	Configures SNMPv3 users from a remote device
Show SNMPv3 Remote User	Shows SNMPv3 users set from a remote device

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Configure Notification	
Add	Configures notification managers to receive messages on key events that occur this switch
Show	Shows configured notification managers
RMON	Remote Monitoring
Configure Global	
Add	
Alarm	Sets threshold bounds for a monitored variable
Event	Creates a response event for an alarm
Show	
Alarm	Shows all configured alarms
Event	Shows all configured events
Configure Interface	
Add	
History	Periodically samples statistics on a physical interface
Statistics	Enables collection of statistics on a physical interface
Show	
History	Shows sampling parameters for each entry in the history group
Statistics	Shows sampling parameters for each entry in the statistics group
Show Details	
History	Shows sampled data for each entry in the history group
Statistics	Shows sampled data for each entry in the history group
Cluster	
Configure Global	Globally enables clustering for the switch; sets Commander status
Configure Member	
Add	Adds switch Members to the cluster
Show	Shows cluster members
Show Candidate	Shows cluster candidates
Show Member	Shows cluster switch member; managed switch members
Time Range	Sets active time range for various functions, including ACL and PoE
Add	Specifies the name of a time range
Show	Shows the name of configured time ranges
Add Rule	
Absolute	Sets exact time or time range
Periodic	Sets a recurrent time

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Show Rule	Shows the time specified by a rule
IP	
General	
Ping	Sends ICMP echo request packets to another node on the network
ARP	Address Resolution Protocol
Configure General	Sets the aging time for dynamic entries in the ARP cache
Show Information	Shows entries in the Address Resolution Protocol (ARP) cache
IPv6 Configuration	
Configure Global	Sets an IPv6 default gateway for traffic with no known next hop
Configure Interface	Configures IPv6 interface address using auto-configuration or link-local address, and sets related protocol settings
Add IPv6 Address	Adds an global unicast, EUI-64, or link-local IPv6 address to an interface
Show IPv6 Address	Show the IPv6 addresses assigned to an interface
Show IPv6 Neighbor Cache	Displays information in the IPv6 neighbor discovery cache
Show Statistics	
IPv6	Shows statistics about IPv6 traffic
ICMPv6	Shows statistics about ICMPv6 messages
UDP	Shows statistics about UDP messages
IP Service	
DNS	Domain Name Service
General	
Configure Global	Enables DNS lookup; defines the default domain name appended to incomplete host names
Add Domain Name	Defines a list of domain names that can be appended to incomplete host names
Show Domain Names	Shows the configured domain name list
Add Name Server	Specifies IP address of name servers for dynamic lookup
Show Name Servers	Shows the name server address list
Static Host Table	
Add	Configures static entries for domain name to address mapping
Show	Shows the list of static mapping entries
Modify	Modifies the static address mapped to the selected host name
Cache	Displays cache entries discovered by designated name servers

Table 4-2. Switch Main Menu (Continued)

Menu	Description
DHCP	Dynamic Host Configuration Protocol
Snooping	
Configure Global	Enables DHCP snooping globally, MAC-address verification, information option; and sets the information policy
Configure VLAN	Enables DHCP snooping on a VLAN
Configure Interface	Sets the trust mode for an interface
Show Information	Displays the DHCP Snooping binding information
Multicast	
IGMP Snooping	
General	Enables multicast filtering; configures parameters for multicast snooping
Multicast Router	
Add Static Multicast Router	Assigns ports that are attached to a neighboring multicast router
Show Static Multicast Router	Displays ports statically configured as attached to a neighboring multicast router
Show Current Multicast Router	Displays ports attached to a neighboring multicast router, either through static or dynamic configuration
IGMP Member	
Add Static Member	Statically assigns multicast addresses to the selected VLAN
Show Static Member	Shows multicast addresses statically configured on the selected VLAN
Show Current Member	Shows multicast addresses associated with the selected VLAN, either through static or dynamic configuration
Interface	
Configure	Configures IGMP snooping per VLAN interface
Show	Shows IGMP snooping settings per VLAN interface
Forwarding Entry	Displays the current multicast groups learned through IGMP Snooping
Filter	
Configure General	Enables IGMP filtering for the switch
Configure Profile	
Add	Adds IGMP filter profile; and sets access mode
Show	Shows configured IGMP filter profiles
Add Multicast Group Range	Assigns multicast groups to selected profile
Show Multicast Group Range	Shows multicast groups assigned to a profile

Table 4-2. Switch Main Menu (Continued)

Menu	Description
Configure Interface	Assigns IGMP filter profiles to port interfaces and sets throttling action
MVR	Multicast VLAN Registration
Configure General	Globally enables MVR, sets the MVR VLAN, adds multicast stream addresses
Configure Interface	Configures MVR interface type and immediate leave mode; also displays MVR operational and active status
Configure Static Group Member	
Add	Statically assigns MVR multicast streams to an interface
Show	Shows MVR multicast streams assigned to an interface
Show Member	Shows the interfaces associated with multicast groups assigned to the MVR VLAN

Chapter 5
Basic Management Tasks

This chapter describes the following topics:

- Displaying System Information – Provides basic system description, including contact information.
- Displaying Switch Hardware/Software Versions – Shows the hardware version, power status, and firmware versions
- Configuring Support for Jumbo Frames – Enables support for jumbo frames.
- Displaying Bridge Extension Capabilities – Shows the bridge extension parameters.
- Managing System Files – Describes how to upgrade operating software or configuration files, and set the system start-up files.
- Setting the System Clock – Sets the current time manually or through specified SNTP servers.
- Configuring the Console Port – Sets console port connection parameters.
- Configuring Telnet Settings – Sets Telnet connection parameters.
- Displaying CPU Utilization – Displays information on CPU utilization.
- Displaying Memory Utilization – Shows memory utilization parameters.
- Resetting the System – Restarts the switch immediately, at a specified time, after a specified delay, or at a periodic interval.

5-1 Displaying System Information

Use the SYSTEM > GENERAL page to identify the system by displaying information such as the device name, location and contact information.

CLI References

See Chapter 21: "System Management Commands" on page 21-1 and Chapter 22: "SNMP Commands" on page 22-1 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **System Description** – Brief description of device type.
- **System Object ID** – MIB II object ID for switch's network management subsystem. (SSE-G2252: 1.3.6.1.4.1.10876.101.202, SSE-G2252P: 1.3.6.1.4.1.10876.101.203)
- **System Up Time** – Length of time the management agent has been up.

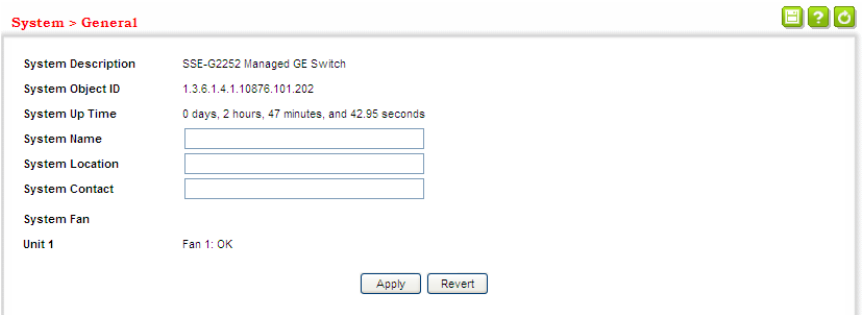
- System Name – Name assigned to the switch system.
- **System Location** – Specifies the system location.
- **System Contact** – Administrator responsible for the system.
- **System Fan** – Shows the current status of all system fans.
  The number of fans provided: SSE-G2252 - 0, SSE-G2252P - 2

Web Interface

To configure general system information:

1. Click SYSTEM > GENERAL.
2. Specify the System Name, Location, and Contact Information for the system administrator.
3. Click APPLY.

Figure 5-1. System Information



5-2 Displaying Switch Hardware/Software Versions

Use the SYSTEM > SWITCH page to display hardware/firmware version numbers for the main board and management software, as well as the power status of the system.

CLI References

See Chapter 21: "System Management Commands" on page 21-1 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

Main Board Information

- **Serial Number** – The serial number of the switch.
- **Number of Ports** – Number of built-in ports.
- **Hardware Version** – Hardware version of the main board.
- **Internal Power Status** – Displays the status of the internal power supply.

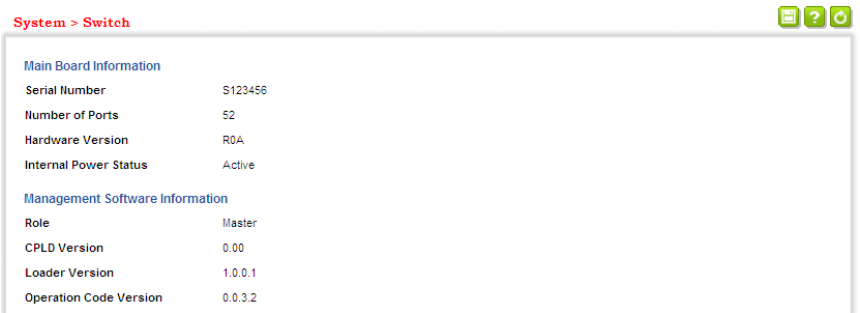
Management Software Information

- **Role** – Shows that this switch is operating as Master or Slave.
- **CPLD Version** – Version number of Complex Programmable Logic Device.
- **Loader Version** – Version number of loader code.
- **Operation Code Version** – Version number of runtime code.

Web Interface

To view hardware and software version information click SYSTEM, then SWITCH.

Figure 5-2. General Switch Information



5-3 Configuring Support for Jumbo Frames

Use the SYSTEM > CAPABILITY page to configure support for jumbo frames. The switch provides more efficient throughput for large sequential data transfers by supporting jumbo frames up to 10240 bytes for Gigabit Ethernet. Compared to standard Ethernet frames that run only up to 1.5 KB, using jumbo frames significantly reduces the per-packet overhead required to process protocol encapsulation fields.

CLI References

See Chapter 21: "System Management Commands" on page 21-1 for CLI reference information.

Usage Guidelines

To use jumbo frames, both the source and destination end nodes (such as a computer or server) must support this feature. Also, when the connection is operating at full duplex, all switches in the network between the two end nodes must be able to accept the extended frame size. And for half-duplex connections, all devices in the collision domain would need to support jumbo frames.

Parameters

The following parameters are displayed in the web interface:

- **Jumbo Frame** – Configures support for jumbo frames. (**Default: Disabled**)

Web Interface

To configure support for jumbo frames:

1. Click SYSTEM, then CAPABILITY.
2. Enable or disable support for jumbo frames.
3. Click APPLY.

Figure 5-3. Configuring Support for Jumbo Frames

5-4 Displaying Bridge Extension Capabilities

Use the SYSTEM > CAPABILITY page to display settings based on the Bridge MIB. The Bridge MIB includes extensions for managed devices that support Multicast Filtering, Traffic Classes, and Virtual LANs. You can access these extensions to display default settings for the key variables.

CLI References

See Section 35-1: "GVRP and Bridge Extension Commands" on page 35-2 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

- **Extended Multicast Filtering Services** – This switch does not support the filtering of individual multicast addresses based on GMRP (GARP Multicast Registration Protocol).

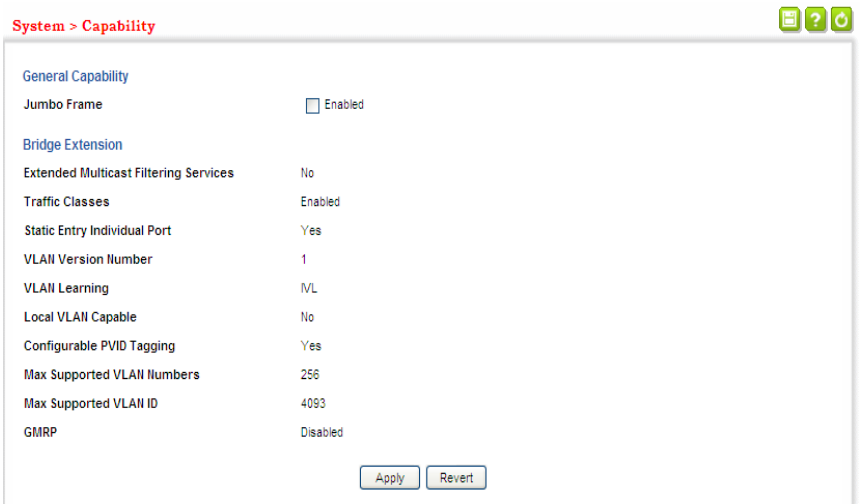
- **Traffic Classes** – This switch provides mapping of user priorities to multiple traffic classes. (Refer to Chapter 11: "Class of Service" on page 11-1.)
- **Static Entry Individual Port** – This switch allows static filtering for unicast and multicast addresses. (Refer to Section 8-1: "Setting Static Addresses" on page 8-1.)
- **VLAN Version Number** – Based on IEEE 802.1Q, “1” indicates Bridges that support only single spanning tree (SST) operation, and “2” indicates Bridges that support multiple spanning tree (MST) operation.
- **VLAN Learning** – This switch uses Independent VLAN Learning (IVL), where each port maintains its own filtering database.
- **Local VLAN Capable** – This switch does not support multiple local bridges outside of the scope of 802.1Q defined VLANs.
- **Configurable PVID Tagging** – This switch allows you to override the default Port VLAN ID (PVID used in frame tags) and egress status (VLAN-Tagged or Untagged) on each port. (Refer to Chapter 7: "VLAN Configuration" on page 7-1.)
- **Max Supported VLAN Numbers** – The maximum number of VLANs supported on this switch.
- **Max Supported VLAN ID** – The maximum configurable VLAN identifier supported on this switch.
- **GMRP** – GARP Multicast Registration Protocol (GMRP) allows network devices to register end stations with multicast groups. This switch does not support GMRP; it uses the Internet Group Management Protocol (IGMP) to provide automatic multicast filtering.

Web Interface

To view Bridge Extension information:

1. Click SYSTEM, then CAPABILITY.
2. Then click APPLY.

Figure 5-4. Displaying Bridge Extension Configuration



5-5 Managing System Files

This section describes how to upgrade the switch operating software or configuration files, and set the system start-up files.

CLI References

See "copy" on page 21-15 for CLI reference information.

Copying Files via FTP/TFTP or HTTP

Use the SYSTEM > FILE (COPY) page to upload/download firmware or configuration settings using FTP, TFTP or HTTP. By backing up a file to an FTP/TFTP server or management station, that file can later be downloaded to the switch to restore operation. Specify the method of file transfer, along with the file type and file names as required.

You can also set the switch to use new firmware or configuration settings without overwriting the current version. Just download the file using a different name from the current version, and then set the new file as the startup file.

Parameters

The following parameters are displayed in the web interface:

- **Copy Type** – The firmware copy operation includes these options:

- FTP Upgrade – Copies a file from an FTP server to the switch.
- FTP Download – Copies a file from the switch to an FTP server.
- HTTP Upgrade – Copies a file from a management station to the switch.
- HTTP Download – Copies a file from the switch to a management station
- TFTP Upgrade – Copies a file from a TFTP server to the switch.
- TFTP Download – Copies a file from the switch to a TFTP server.

- **FTP/TFTP Server IP Address** – The IP address of an FTP/TFTP server.
- **User Name** – The user name for FTP server access.
- **Password** – The password for FTP server access.
- **File Type** – Specify OPERATION > CODE or LOADER.
- **File Name** – The file name should not contain slashes (\ or /), the leading letter of the file name should not be a period (.), and the maximum length for file names is 32 characters for files on the switch or 128 characters for files on the server. (Valid characters: A-Z, a-z, 0-9, ".", "-", "_")
- **Auto Reboot After Opcode Upgrade Completed** – Automatically reboots the switch after the operation code has been upgraded.

NOTE: Up to two copies of the system software (i.e., the runtime firmware) can be stored in the file directory on the switch.

NOTE: The maximum number of user-defined configuration files is limited only by available flash memory space.

NOTE: The file "Factory_Default_Config.cfg" can be copied to a TFTP server or management station, but cannot be used as the destination file name on the switch.

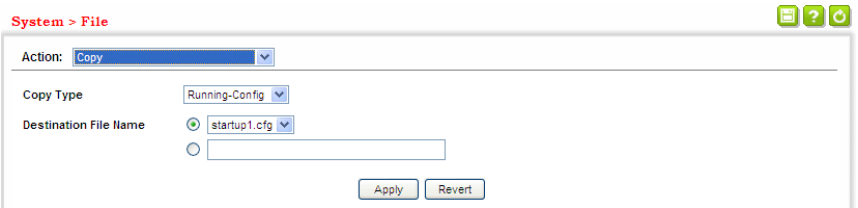
Web Interface

To copy firmware files:

1. Click SYSTEM, then FILE.
2. Select COPY from the Action list.
3. Select FTP UPGRADE, HTTP UPGRADE, or TFTP UPGRADE as the file transfer method.
4. If FTP UPGRADE or TFTP UPGRADE is used, enter the IP address of the file server.
5. If FTP UPGRADE is used, enter the User Name and Password for your account on the FTP server.

6. Set the file type to OPERATION > CODE or LOADER.
7. Enter the name of the file to download.
8. Select a file on the switch to overwrite or specify a new file name.
9. Then click APPLY.

Figure 5-5. Copy Firmware



If you replaced a file currently used for startup and want to start using the new file, reboot the system via the SYSTEM > RESET menu.

Saving the Running Configuration to a Local File

Use the SYSTEM > FILE (COPY) page to save the current configuration settings to a local file on the switch. The configuration settings are not automatically saved by the system for subsequent use when the switch is rebooted. You must save these settings to the current startup file, or to another file which can be subsequently set as the startup file.

See "copy" on page 21-15 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

- **Copy Type** – The copy operation includes this option:
  - Running-Config – Copies the current configuration settings to a local file on the switch.
- **Destination File Name** – Copy to the currently designated startup file, or to a new file. The file name should not contain slashes (\ or /), the leading letter of the file name should not be a period (.), and the maximum length for file names is 32 characters for files on the switch. (Valid characters: A-Z, a-z, 0-9, ".", "-", "_")

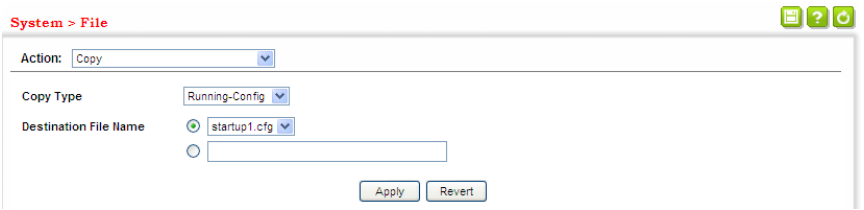
NOTE: The maximum number of user-defined configuration files is limited only by available flash memory space.

Web Interface

To save the running configuration file:

1. Click SYSTEM, then FILE.
2. Select COPY from the Action list.
3. Select RUNNING-CONFIG from the COPY TYPE list.
4. Select the current startup file on the switch to overwrite or specify a new file name.
5. Then click APPLY.

Figure 5-6. Saving the Running Configuration



If you replaced a file currently used for startup and want to start using the new file, reboot the system via the SYSTEM > RESET menu.

Setting The Start-Up File

Use the SYSTEM > FILE (SET START-UP) page to specify the firmware or configuration file to use for system initialization.

CLI References

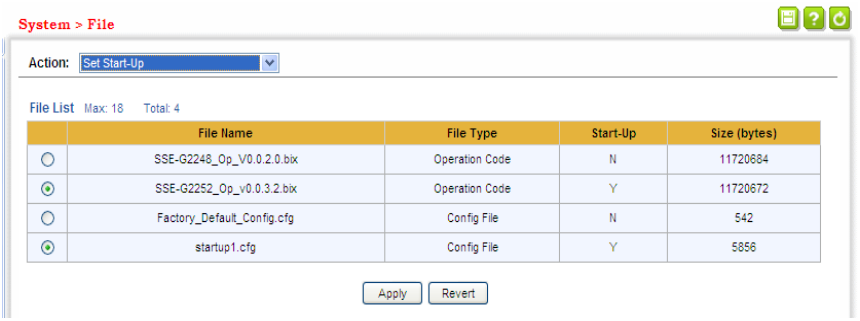
See "whichboot" on page 21-20 and "boot system" on page 21-14 for CLI reference information.

Web Interface

To set a file to use for system initialization:

1. Click SYSTEM, then FILE.
2. Select SET START-UP from the Action list.
3. Mark the operation code or configuration file to be used at startup
4. Then click APPLY.

Figure 5-7. Setting Start-Up Files



To start using the new firmware or configuration settings, reboot the system via the System > Reset menu.

Showing System Files

Use the System > File (Show) page to show the files in the system directory, or to delete a file.

NOTE: Files designated for start-up, and the Factory_Default_Config.cfg file, cannot be deleted.

CLI References

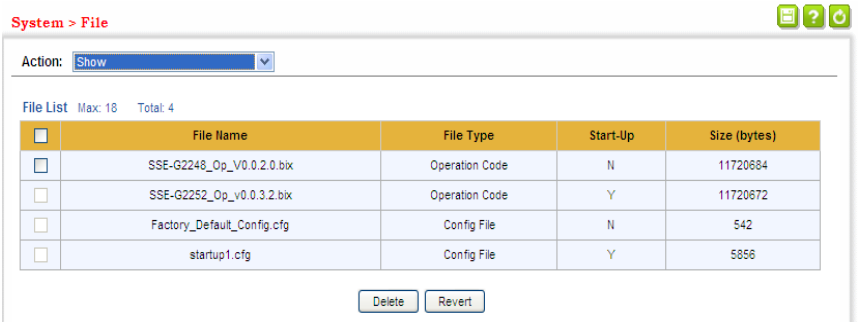
See "dir" on page 21-18 and "delete" on page 21-18 for CLI reference information.

Web Interface

To show the system files:

1. Click System, then File.
2. Select Show from the Action list.
3. To delete a file, mark it in the File List and click Delete.

Figure 5-8. Displaying System Files



Automatic Operation Code Upgrade

Use the SYSTEM > FILE (AUTOMATIC OPERATION CODE UPGRADE) page to automatically download an operation code file when a file newer than the currently installed one is discovered on the file server. After the file is transferred from the server and successfully written to the file system, it is automatically set as the startup file, and the switch is rebooted.

CLI References

See "upgrade opcode auto" on page 21-20 and "upgrade opcode path" on page 21-22 for CLI reference information.

Usage Guidelines

- If this feature is enabled, the switch searches the defined URL once during the bootup sequence.
- FTP (port 21) and TFTP (port 69) are both supported. Note that the TCP/UDP port bindings cannot be modified to support servers listening on non-standard ports.
- The host portion of the upgrade file location URL must be a valid IPv4 IP address. DNS host names are not recognized. Valid IP addresses consist of four numbers, 0 to 255, separated by periods.
- The path to the directory must also be defined. If the file is stored in the root directory for the FTP/TFTP service, then use the "/" to indicate this (e.g., ftp://192.168.0.1/).
- The file name must not be included in the upgrade file location URL. The file name of the code stored on the remote server must be *SSE-G2252_Op.bix* (using upper case and lower case letters exactly as indicated here). Enter the file name for other switches described in this manual exactly as shown on the web interface.

- The FTP connection is made with PASV mode enabled. PASV mode is needed to traverse some fire walls, even if FTP traffic is not blocked. PASV mode cannot be disabled.
- The switch-based search function is case-insensitive in that it will accept a file name in upper or lower case (i.e., the switch will accept *SSE-G2252_OP.BIX* from the server even though *SSE-G2252_Op.bix* was requested). However, keep in mind that the file systems of many operating systems such as Unix and most Unix-like systems (FreeBSD, NetBSD, OpenBSD, and most Linux distributions, etc.) are case-sensitive, meaning that two files in the same directory, *SSE-G2252_op.bix* and *SSE-G2252_Op.bix* are considered to be unique files. Thus, if the upgrade file is stored as *SSE-G2252_Op.bix* (or even *SSE-G2252_op.bix*) on a case-sensitive server, then the switch (requesting *SSE-G2252_op.bix*) will not be upgraded because the server does not recognize the requested file name and the stored file name as being equal. A notable exception in the list of case-sensitive Unix-like operating systems is Mac OS X, which by default is case-insensitive. Please check the documentation for your server's operating system if you are unsure of its file system's behavior.
- Note that the switch itself does not distinguish between upper and lower-case file names, and only checks to see if the file stored on the server is more recent than the current runtime image.
- If two operation code image files are already stored on the switch's file system, then the non-startup image is deleted before the upgrade image is transferred.
- The automatic upgrade process will take place in the background without impeding normal operations (data switching, etc.) of the switch.
- During the automatic search and transfer process, the administrator cannot transfer or update another operation code image, configuration file, public key, or HTTPS certificate (i.e., no other concurrent file management operations are possible).
- The upgrade operation code image is set as the startup image after it has been successfully written to the file system.
- The switch will send an SNMP trap and make a log entry upon all upgrade successes and failures.
- The switch will immediately restart after the upgrade file is successfully written to the file system and set as the startup image.

Parameters

The following parameters are displayed in the web interface:

- **Automatic Opcode Upgrade** – Enables the switch to search for an upgraded operation code file during the switch bootup process. (Default: Disabled)
- **Automatic Upgrade Location URL** – Defines where the switch should search for the operation code upgrade file. The last character of this URL must be a forward slash ("/"). The *SSE-G2252_Op.bix* filename must not be included since it is automatically appended by the switch. (Options: ftp, tftp)

The following syntax must be observed:

tftp://*host*[*/filedir*]*/*

- **tftp://** – Defines TFTP protocol for the server connection.
- *host* – Defines the IP address of the TFTP server. Valid IP addresses consist of four numbers, 0 to 255, separated by periods. DNS host names are not recognized.
- *filedir* – Defines the directory, relative to the TFTP server root, where the upgrade file can be found. Nested directory structures are accepted. The directory name must be separated from the host, and in nested directory structures, from the parent directory, with a prepended forward slash "/".
- / – The forward slash must be the last character of the URL.

ftp://[*username*[**:***password***@**]]*host*[*/filedir*]*/*

- **ftp://** – Defines FTP protocol for the server connection.
- *username* – Defines the user name for the FTP connection. If the user name is omitted, then "anonymous" is the assumed user name for the connection.
- *password* – Defines the password for the FTP connection. To differentiate the password from the user name and host portions of the URL, a colon (:) must precede the password, and an "at" symbol (@), must follow the password. If the password is omitted, then "" (an empty string) is the assumed password for the connection.
- *host* – Defines the IP address of the FTP server. Valid IP addresses consist of four numbers, 0 to 255, separated by periods. DNS host names are not recognized.
- *filedir* – Defines the directory, relative to the FTP server root, where the upgrade file can be found. Nested directory structures are accepted. The directory name must be separated from the host, and in nested directory structures, from the parent directory, with a prepended forward slash "/".
- **/** – The forward slash must be the last character of the URL.

Examples

The following examples demonstrate the URL syntax for a TFTP server at IP address 192.168.0.1 with the operation code image stored in various locations:

- tftp://192.168.0.1/
  The image file is in the TFTP root directory.
- tftp://192.168.0.1/switch-opcode/
  The image file is in the "switch-opcode" directory, relative to the TFTP root.
- tftp://192.168.0.1/switches/opcode/
  The image file is in the "opcode" directory, which is within the "switches" parent directory, relative to the TFTP root.

The following examples demonstrate the URL syntax for an FTP server at IP address 192.168.0.1 with various user name, password and file location options presented:

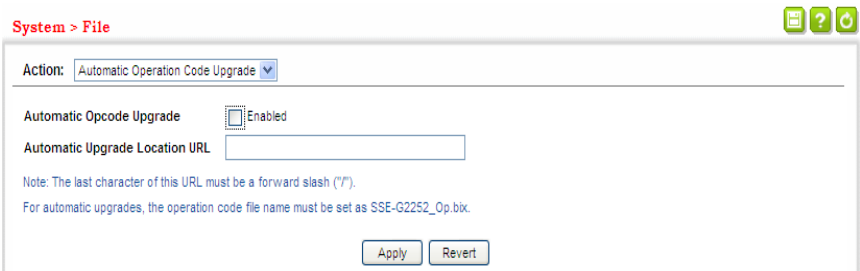
- ftp://192.168.0.1/
  The user name and password are empty, so "anonymous" will be the user name and the password will be blank. The image file is in the FTP root directory.
- ftp://switches:upgrade@192.168.0.1/
  The user name is "switches" and the password is "upgrade". The image file is in the FTP root.
- ftp://switches:upgrade@192.168.0.1/switches/opcode/
  The user name is "switches" and the password is "upgrade". The image file is in the "opcode" directory, which is within the "switches" parent directory, relative to the FTP root.

Web Interface

To configure automatic code upgrade:

1. Click SYSTEM, then FILE.
2. Select AUTOMATIC OPERATION CODE UPGRADE from the Action list.
3. Mark the check box to enable AUTOMATIC OPCODE UPGRADE.
4. Enter the URL of the FTP or TFTP server, and the path and directory containing the operation code.
5. Click APPLY.

Figure 5-9. Configuring Automatic Code Upgrade


System > File
Action:
Automatic Operation Code Upgrade
Automatic Opcode Upgrade
Enabled
Automatic Upgrade Location URL
Note: The last character of this URL must be a forward slash ("/").
For automatic upgrades, the operation code file name must be set as SSE-G2252_Op.bix.
Apply
Revert

If a new image is found at the specified location, the following type of messages will be displayed during bootup.

```
.
.
.
Automatic Upgrade is looking for a new image
New image detected: current version 1.0.1.5; new version 1.1.2.0
Image upgrade in progress
The switch will restart after upgrade succeeds
Downloading new image
Flash programming started
Flash programming completed
The switch will now restart
```

.
.
.

5-6 Setting the System Clock

Simple Network Time Protocol (SNTP) allows the switch to set its internal clock based on periodic updates from a time server (SNTP or NTP). Maintaining an accurate time on the switch enables the system log to record meaningful dates and times for event entries. You can also manually set the clock. If the clock is not set manually or via SNTP, the switch will only record the time from the factory default set at the last bootup.

When the SNTP client is enabled, the switch periodically sends a request for a time update to a configured time server. You can configure up to three time server IP addresses. The switch will attempt to poll each server in the configured sequence.

Setting the Time Manually

Use the SYSTEM > TIME (CONFIGURE GENERAL - MANUALLY) page to set the system time on the switch manually without using SNTP.

CLI References

See "calendar set" on page 21-58 and "show calendar" on page 21-59 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

- **Current Time** – Shows the current time set on the switch.
- **Hours** – Sets the hour. (Range: 0-23; Default: 0)
- **Minutes** – Sets the minute value. (Range: 0-59; Default: 0)
- **Seconds** – Sets the second value. (Range: 0-59; Default: 0)
- **Month** – Sets the month. (Range: 1-12; Default: 1)
- **Day** – Sets the day of the month. (Range: 1-31; Default: 1)
- **Year** – Sets the year. (Range: 2001-2100; Default: 2009)

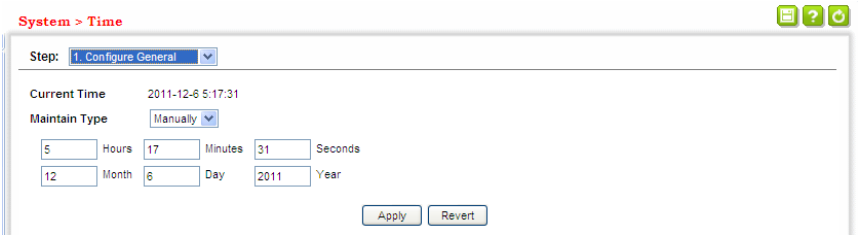
Web Interface

To manually set the system clock:

1. Click SYSTEM, then TIME.
2. Select CONFIGURE GENERAL from the Action list.
3. Select MANUALLY from the Maintain Type list.
4. Enter the time and date in the appropriate fields.

5. Click APPLY

Figure 5-10. Manually Setting the System Clock



Setting the SNTP Polling Interval

Use the SYSTEM > TIME (CONFIGURE GENERAL - SNTP) page to set the polling interval at which the switch will query the specified time servers.

Parameters

The following parameters are displayed in the web interface:

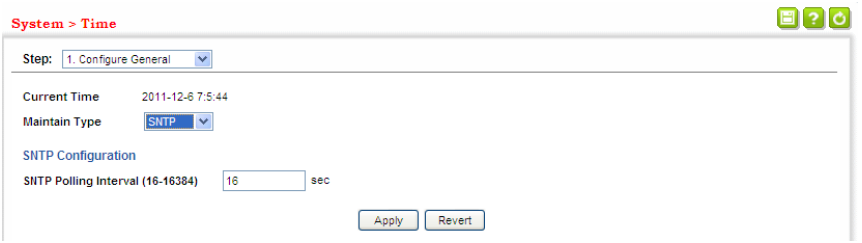
- **Current Time** – Shows the current time set on the switch.
- **SNTP Polling Interval** – Sets the interval between sending requests for a time update from a time server. (Range: 16-16384 seconds; Default: 16 seconds)

Web Interface

To set the polling interval for SNTP:

1. Click SYSTEM, then TIME.
2. Select CONFIGURE GENERAL from the Action list.
3. Select SNTP from the Maintain Type list.
4. Modify the polling interval if required.
5. Click APPLY.

Figure 5-11. Setting the Polling Interval for SNTP



Specifying SNTP Time Servers

Use the SYSTEM > TIME (CONFIGURE TIME SERVER) page to specify the IP address for up to three SNTP time servers.

CLI References

See "sntp server" on page 21-54 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

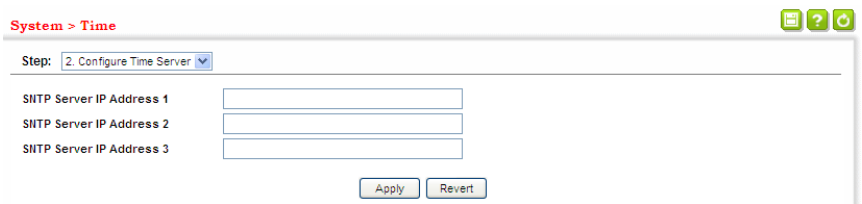
- **SNTP Server IP Address** – Sets the IPv4 or IPv6 address for up to three time servers. The switch attempts to update the time from the first server, if this fails it attempts an update from the next server in the sequence.

Web Interface

To set the SNTP time servers:

1. Click SYSTEM, then TIME.
2. Select CONFIGURE TIME SERVER from the Action list.
3. Enter the IP address of up to three time servers.
4. Click APPLY.

Figure 5-12. Specifying SNTP Time Servers



Setting the Time Zone

Use the SYSTEM > TIME (CONFIGURE TIME SERVER) page to set the time zone. SNTP uses Coordinated Universal Time (or UTC, formerly Greenwich Mean Time, or GMT) based on the time at the Earth's prime meridian, zero degrees longitude, which passes through Greenwich, England. To display a time corresponding to your local time, you must indicate the number of hours and minutes your time zone is east (before) or west (after) of UTC. You can choose one of the 80 predefined time zone definitions, or your can manually configure the parameters for your local time zone.

CLI References

See "clock timezone" on page 21-56 and "clock timezone-predefined" on page 21-57 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

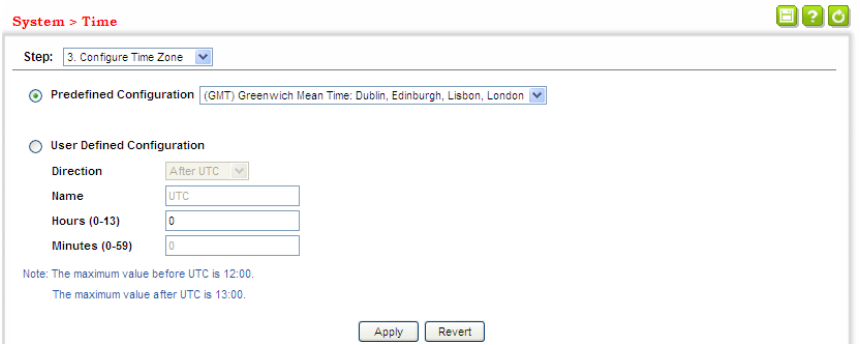
- **Predefined Configuration** – A drop-down box provides access to the 80 predefined time zone configurations. Each choice indicates it's offset from UTC and lists at least one major city or location covered by the time zone.
- **User-defined Configuration** – Allows the user to define all parameters of the local time zone.
  - **Direction** – Configures the time zone to be before (east of) or after (west of) UTC.
  - **Name** – Assigns a name to the time zone. (Range: 1-29 characters)
  - **Hours** (0-13) – The number of hours before/after UTC. The maximum value before UTC is 12. The maximum value after UTC is 13.
  - **Minutes** (0-59) – The number of minutes before/after UTC.

Web Interface

To set your local time zone:

1. Click SYSTEM, then TIME.
2. Select CONFIGURE TIME ZONE from the Action list.
3. Set the offset for your time zone relative to the UTC in hours and minutes using either a predefined or custom definition.
4. Click APPLY.

Figure 5-13. Setting the Time Zone



5-7 Configuring the Console Port

Use the SYSTEM > CONSOLE menu to configure connection parameters for the switch's console port. You can access the onboard configuration program by attaching a VT100 compatible device to the switch's serial console port. Management access through the console port is controlled by various parameters, including a password (only configurable through the CLI), time outs, and basic communication settings. Note that these parameters can be configured via the web or CLI interface.

CLI References

See "line" on page 21-24 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

- **Login Timeout** – Sets the interval that the system waits for a user to log into the CLI. If a login attempt is not detected within the timeout interval, the connection is terminated for the session. (Range: 0-300 seconds; Default: 0 seconds)
- **Exec Timeout** – Sets the interval that the system waits until user input is detected. If user input is not detected within the timeout interval, the current session is terminated. (Range: 0-65535 seconds; Default: 600 seconds)
- **Password Threshold** – Sets the password intrusion threshold, which limits the number of failed logon attempts. When the logon attempt threshold is reached, the system interface becomes silent for a specified amount of time (set by the Silent Time parameter) before allowing the next logon attempt.
  (Range: 0-120; Default: 3 attempts)
- **Silent Time** – Sets the amount of time the management console is inaccessible after the number of unsuccessful logon attempts has been exceeded.
  (Range: 0-65535 seconds; Default: 30 seconds)

- **Data Bits** – Sets the number of data bits per character that are interpreted and generated by the console port. If parity is being generated, specify 7 data bits per character. If no parity is required, specify 8 data bits per character. (Default: 8 bits)
- **Stop Bits** – Sets the number of the stop bits transmitted per byte. (Range: 1-2; Default: 1 stop bit)
- **Parity** – Defines the generation of a parity bit. Communication protocols provided by some terminals can require a specific parity bit setting. Specify Even, Odd, or None. (Default: None)
- **Speed** – Sets the terminal line's baud rate for transmit (to terminal) and receive (from terminal). Set the speed to match the baud rate of the device connected to the serial port. (Range: 9600, 19200, 38400, 57600 or 115200 baud, Auto; Default: Auto)

NOTE: Due to a hardware limitation, the terminal program connected to the console port must be set to 8 data bits when using Auto baud rate detection.

NOTE: The password for the console connection can only be configured through the CLI (see "password" on page 21-29).

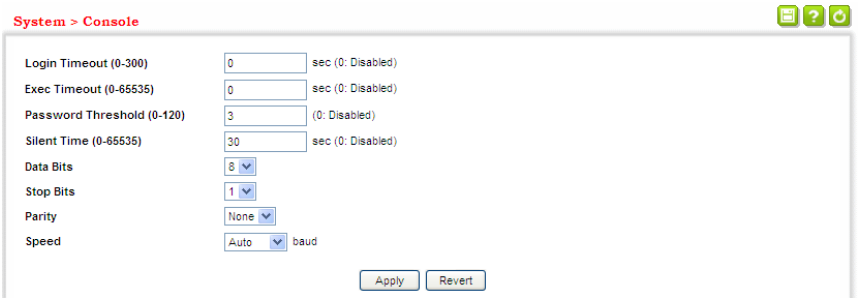
NOTE: Password checking can be enabled or disabled for logging in to the console connection (see "login" on page 21-27). You can select authentication by a single global password as configured for the password command, or by passwords set up for specific user-name accounts. The default is for local passwords configured on the switch.

Web Interface

To configure parameters for the console port:

1. Click SYSTEM, then CONSOLE.
2. Specify the connection parameters as required.
3. Click APPLY

Figure 5-14. Console Port Settings



5-8 Configuring Telnet Settings

Use the SYSTEM > TELNET menu to configure parameters for accessing the CLI over a Telnet connection. You can access the onboard configuration program over the network using Telnet (i.e., a virtual terminal). Management access via Telnet can be enabled/ disabled and other parameters set, including the TCP port number, time outs, and a password. Note that the password is only configurable through the CLI.) These parameters can be configured via the web or CLI interface.

CLI References

See "line" on page 21-24 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

- **Telnet Status** – Enables or disables Telnet access to the switch. (Default: Enabled)
- **TCP Port** – Sets the TCP port number for Telnet on the switch. (Default: 23)
- **Login Timeout** – Sets the interval that the system waits for a user to log into the CLI. If a login attempt is not detected within the timeout interval, the connection is terminated for the session. (Range: 1-300 seconds; Default: 300 seconds)
- **Exec Timeout** – Sets the interval that the system waits until user input is detected. If user input is not detected within the timeout interval, the current session is terminated. (Range: 1-65535 seconds; Default: 600 seconds)
- **Password Threshold** – Sets the password intrusion threshold, which limits the number of failed logon attempts. When the logon attempt threshold is reached, the system interface becomes silent for a specified amount of time (set by the Silent Time parameter) before allowing the next logon attempt.
  (Range: 0-120; Default: 3 attempts)

- **Silent Time** – Sets the amount of time the management interface is inaccessible after the number of unsuccessful logon attempts has been exceeded. (Range: 0-65535 seconds; Default: 30 seconds)
- **Max Sessions** – Sets the maximum number of Telnet sessions that can simultaneously connect to this system. (Range: 0-4; Default: 4)

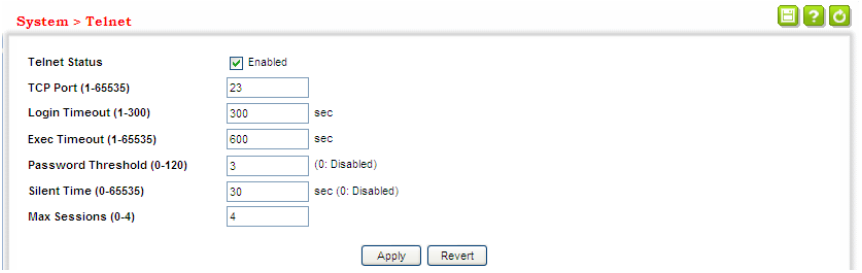
NOTE: Password checking can be enabled or disabled for login to the console connection (see "login" on page 21-27). You can select authentication by a single global password as configured for the password command, or by passwords set up for specific user-name accounts. The default is for local passwords configured on the switch.

Web Interface

To configure parameters for the console port:

1. Click SYSTEM, then TELNET.
2. Specify the connection parameters as required.
3. Click APPLY.

Figure 5-15. Telnet Connection Settings



5-9 Displaying CPU Utilization

Use the SYSTEM > CPU UTILIZATION page to display information on CPU utilization.

CLI References

See "show process cpu" on page 21-4 for CLI reference information.l

Parameters

The following parameters are displayed in the web interface:

- **Time Interval** – The interval at which to update the displayed utilization rate. (Options: 1, 5, 10, 30, 60 seconds; Default: 1 second)

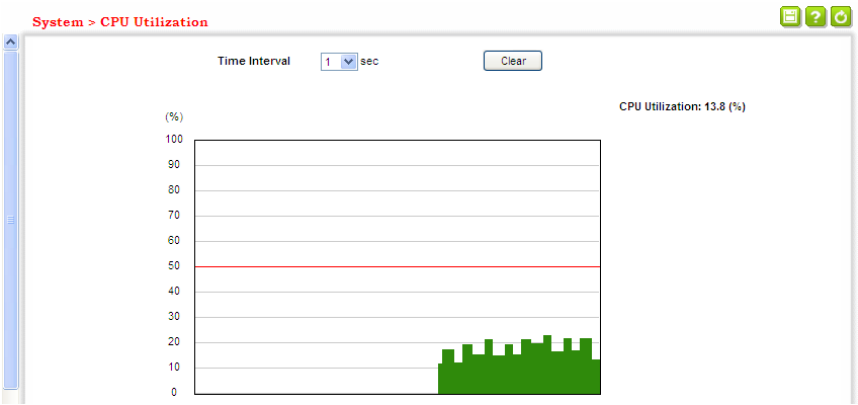
- **CPU Utilization** – CPU utilization over specified interval.

Web Interface

To display CPU utilization:

1. Click SYSTEM, then CPU UTILIZATION.
2. Change the update interval if required. Note that the interval is changed as soon as a new setting is selected.

Figure 5-16. Displaying CPU Utilization



5-10 Displaying Memory Utilization

Use the SYSTEM > MEMORY STATUS page to display memory utilization parameters.

CLI References

See "show memory" on page 21-4 for CLI reference information.

Parameters

The following parameters are displayed in the web interface:

- **Free Size** – The amount of memory currently free for use.
- **Used Size** – The amount of memory allocated to active processes.
- **Total** – The total amount of system memory.

Web Interface

To display memory utilization click SYSTEM, then MEMORY STATUS.

Figure 5-17. Displaying Memory Utilization

5-11 Resetting the System

Use the SYSTEM > RELOAD menu to restart the switch immediately, at a specified time, after a specified delay, or at a periodic interval.

CLI References

See the following for CLI reference information:

- "reload (Privileged Exec)" on page 20-6
- "reload (Global Configuration)" on page 20-2
- "show reload" on page 20-7
- ""copy" running-config startup-config" on page 21-15

Command Usage

- This command resets the entire system.
- To retain all configuration information stored in non-volatile memory, click the SAVE button prior to resetting the system.
- When the system is restarted, it will always run the Power-On Self-Test.

Parameters

The following parameters are displayed in the web interface:

System Reload Configuration

- **Reload Mode** – Restarts the switch immediately or at the specified time(s).
  - **Immediately** – Restarts the system immediately.
- **In** – Specifies an interval after which to reload the switch. (The specified time must be equal to or less than 24 days.)
  - *hours* – The number of hours, combined with the minutes, before the switch resets. (Range: 0-576)

- *minutes* – The number of minutes, combined with the hours, before the switch resets. (Range: 0-59)

- **At** – Specifies a periodic interval at which to reload the switch.
  - DD - The day of the month at which to reload. (Range: 1-31)
  - MM - The month at which to reload. (january ... december)
  - YYYY - The year at which to reload. (Range: 2001-2050)
  - HH - The hour at which to reload. (Range: 0-23)
  - MM - The minute at which to reload. (Range: 0-59)
- **Regularly** – Specifies a periodic interval at which to reload the switch.

  Time
  - HH - The hour at which to reload. (Range: 0-23)
  - MM - The minute at which to reload. (Range: 0-59)

  Period
  - Daily - Every day.
  - Weekly - Day of the week at which to reload. (Range: Sunday ... Saturday)
  - Monthly - Day of the month at which to reload. (Range: 1-31)

Save Current Settings

- **Save** – Click this button to save the current configuration settings.

Use Factory Default Settings and Reboot

- **Factory Default Settings & Reboot** – Click this button to restore the factory default settings and reboot the system.

Web Interface

To restart the switch:

1. Click SYSTEM, then RELOAD.
2. Select the required reload mode.
3. For any option other than to reset immediately, fill in the required parameters
4. Click APPLY.
5. When prompted, confirm that you want reset the switch.

Figure 5-18. Restarting the Switch (Immediately)

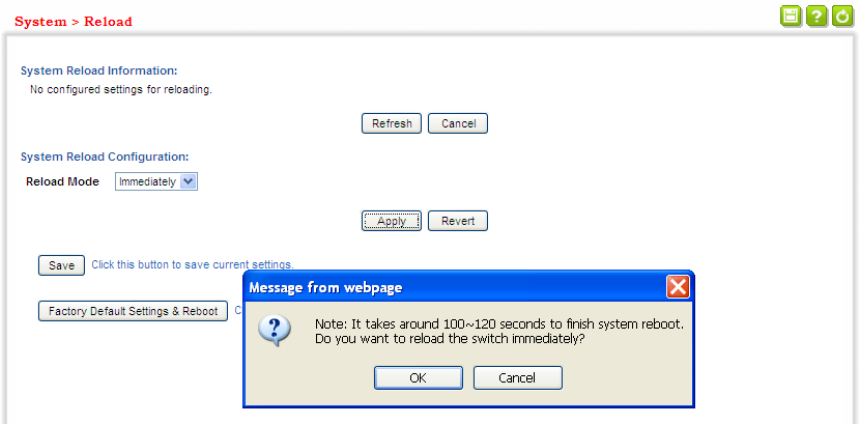


Figure 5-19. Restarting the Switch (In)

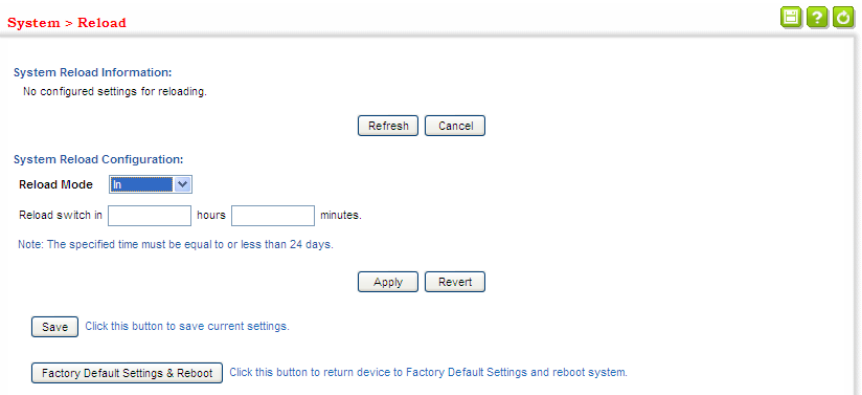


Figure 5-20. Restarting the Switch (At)

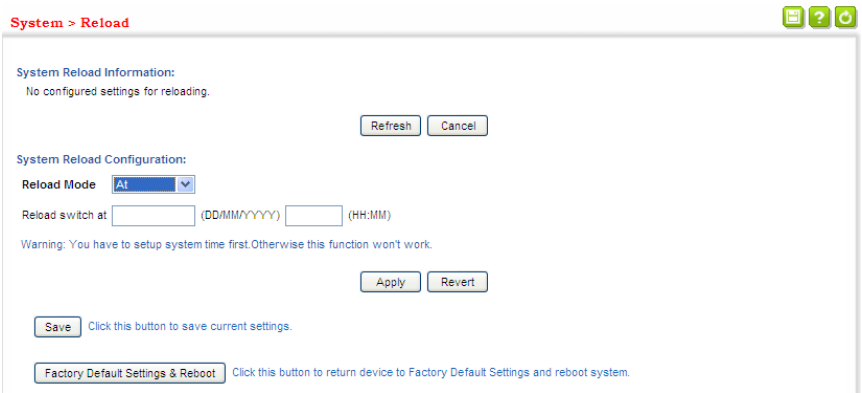
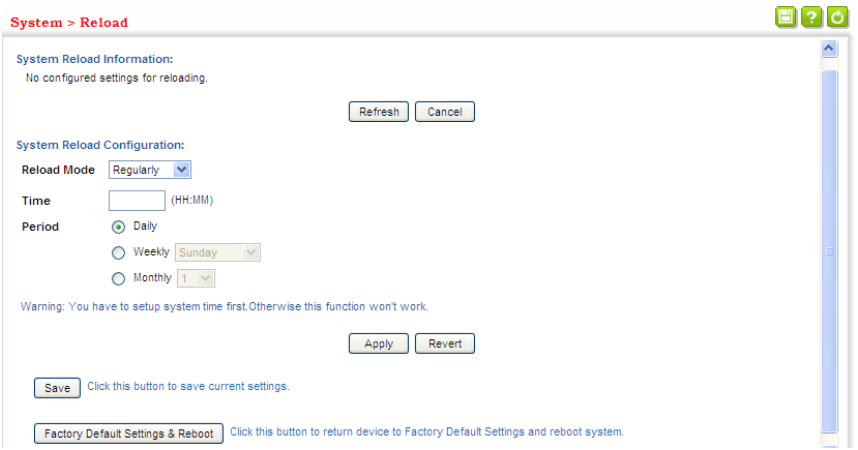


Figure 5-21. Restarting the Switch (Regularly)



Chapter 6
Interface Configuration

This chapter describes the following topics:

- Port Configuration – Configures connection settings, including auto-negotiation, or manual setting of speed, duplex mode, and flow control.
- Configuring Local Port Mirroring – Sets the source and target ports for mirroring on the local switch.
- Configuring Remote Port Mirroring – Configures mirroring of traffic from remote switches for analysis at a destination port on the local switch.
- Trunk Configuration – Configures static or dynamic trunks.
- Saving Power – Adjusts the power provided to ports based on the length of the cable used to connect to other devices.
- Traffic Segmentation – Configures the uplinks and down links to a segmented group of ports.
- VLAN Trunking – Configures a tunnel across one or more intermediate switches which pass traffic for VLAN groups to which they do not belong.

6-1 Port Configuration

This section describes how to configure port connections, mirror traffic from one port to another, and run cable diagnostics.

Configuring by Port List

Use the INTERFACE > PORT > GENERAL (CONFIGURE BY PORT LIST) page to enable/disable an interface, set auto-negotiation and the interface capabilities to advertise, or manually fix the speed, duplex mode, and flow control.

CLI References

See Chapter 27: "Interface Commands" on page 27-1 for CLI reference information.

Command Usage

- Auto-negotiation must be disabled before you can configure or force an interface to use the Speed/Duplex mode or Flow Control options.
- When using auto-negotiation, the optimal settings will be negotiated between the link partners based on their advertised capabilities. To set the speed, duplex mode, or flow control under auto-negotiation, the required operation modes must be specified in the capabilities list for an interface.

- The 1000BASE-T standard does not support forced mode. Auto-negotiation should always be used to establish a connection over any 1000BASE-T port or trunk. If not used, the success of the link process cannot be guaranteed when connecting to other types of switches.
- The Speed/Duplex mode is fixed at 1000full on the Gigabit SFP ports. When auto-negotiation is enabled, the only attributes which can be advertised include flow control and symmetric pause frames.

Parameters

These parameters are displayed in the web interface:

- **Port** – Port identifier.
- **Type** – Indicates the port type. (100Base-TX, 1000Base-T, 100Base SFP, 1000Base SFP)
- **Name** – Allows you to label an interface. (Range: 1-64 characters)
- **Admin** – Allows you to manually disable an interface. You can disable an interface due to abnormal behavior (e.g., excessive collisions), and then re-enable it after the problem has been resolved. You may also disable an interface for security reasons.
- **Media Type** – Configures the forced/preferred port type to use for the combination ports (49-52 on the SSE-G2252/P).
  - **Copper-Forced** - Always uses the built-in RJ-45 port.
  - **SFP-Forced** - Always uses the SFP port (even if a module is not installed).
  - **SFP-Preferred-Auto** - Uses SFP port if both combination types are functioning and the SFP port has a valid link. (This is the default for the combination ports.)
- **Autonegotiation** (Port Capabilities) – Allows auto-negotiation to be enabled/ disabled. When auto-negotiation is enabled, you need to specify the capabilities to be advertised. When auto-negotiation is disabled, you can force the settings for speed, mode, and flow control.The following capabilities are supported.
  - **10h** - Supports 10 Mbps half-duplex operation
  - **10f** - Supports 10 Mbps full-duplex operation
  - **100h** - Supports 100 Mbps half-duplex operation
  - **100f** - Supports 100 Mbps full-duplex operation
  - **1000f** (Gigabit ports only) - Supports 1000 Mbps full-duplex operation
  - **Sym** (Gigabit only) - Check this item to transmit and receive pause frames.
  - **FC** - Flow control can eliminate frame loss by "blocking" traffic from end stations or segments connected directly to the switch when its buffers fill. When enabled, back pressure is used for half-duplex operation and IEEE 802.3-2005 (formally IEEE 802.3x) for full-duplex operation.

Avoid using flow control on a port connected to a hub unless it is actually required to solve a problem. Otherwise back pressure jamming signals may degrade overall performance for the segment attached to the hub.

(Default: Autonegotiation enabled; Advertised capabilities for 100Base-TX – 10half, 10full, 100half, 100full;
1000BASE-T – 10half, 10full, 100half, 100full, 1000full;
1000Base-SX/LX/LH – 1000full)

- **Speed/Duplex** – Allows you to manually set the port speed and duplex mode. (i.e., with auto-negotiation disabled)
- **Giga PHY Mode** – Forces two connected ports into a master/slave configuration to enable 1000BASE-T full duplex for Gigabit ports 49-52 on the SSE-G2252/ SSE-G2252P. The following options are supported:
  - **Master** - Sets the selected port as master.
  - **Slave** - Sets the selected port as slave.

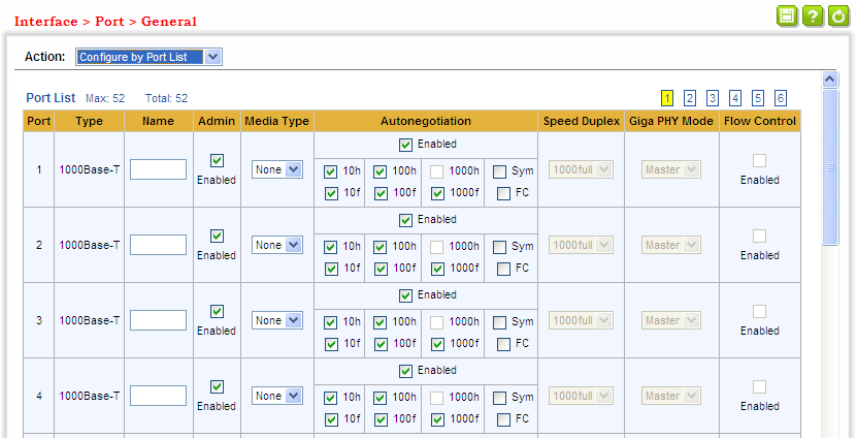
  To force 1000full operation requires the ports at both ends of a link to establish their role in the connection process as a master or slave. Before using this feature, auto-negotiation must first be disabled, and the Speed/Duplex attribute set to 1000full. Then select compatible Giga PHY modes at both ends of the link.
- **Flow Control** – Allows automatic or manual selection of flow control.

Web Interface

To configure port connection parameters:

1. Click INTERFACE > PORT > GENERAL.
2. Select CONFIGURE BY PORT LIST from the Action List.
3. Modify the required interface settings.
4. Click APPLY.

Figure 6-1. Configuring Connections by Port List



Configuring by Port Range

Use the INTERFACE > PORT > GENERAL (CONFIGURE BY PORT RANGE) page to enable/disable an interface, set auto-negotiation and the interface capabilities to advertise, or manually fix the speed, duplex mode, and flow control.

For more information on command usage and a description of the parameters, refer to "Configuring by Port List" on page 6-1.

CLI References

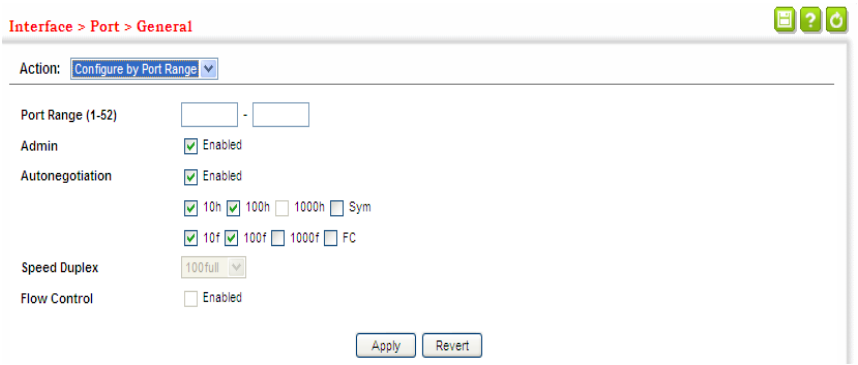
See Chapter 27: "Interface Commands" on page 27-1 for CLI reference information.

Web Interface

To configure port connection parameters:

1. Click INTERFACE > PORT > GENERAL.
2. Select CONFIGURE BY PORT RANGE from the Action List.
3. Enter to range of ports to which your configuration changes apply.
4. Modify the required interface settings.
5. Click APPLY.

Figure 6-2. Configuring Connections by Port Range



Displaying Connection Status

Use the Interface > PORT > GENERAL (SHOW INFORMATION) page to display the current connection status, including link state, speed/duplex mode, flow control, and auto-negotiation.

CLI References

See "show interfaces status" on page 27-15 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Port** – Port identifier.
- **Type** – Indicates the port type. (100Base-TX, 1000Base-T, 100Base SFP or 1000Base SFP)
- **Name** – Interface label.
- **Admin** – Shows if the port is enabled or disabled.
- **Oper Status** – Indicates if the link is Up or Down.
- **Media Type** – Media type used.
  (Options: RJ-45 – Copper-Forced;
  Combination – Copper-Forced, SFP-Forced, or SFP-Preferred-Auto;
  Default: RJ-45 – Copper-Forced; Combination – SFP-Preferred-Auto)
- **Autonegotiation** – Shows if auto-negotiation is enabled or disabled.
- **Oper Speed Duplex** – Shows the current speed and duplex mode.
- **Oper Flow Control** – Shows if flow control is enabled or disabled.

Web Interface

To display port connection parameters:

1. Click INTERFACE > PORT > GENERAL.
2. Select SHOW INFORMATION from the Action List.

Figure 6-3. Displaying Port Information

Interface > Port > General

Action: Show Information

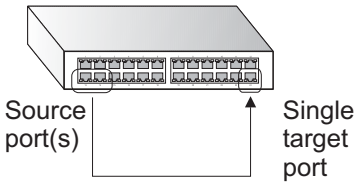
Port List Max: 52 Total: 52 1 2 3 4 5 6

Port	Type	Name	Admin	Oper Status	Media Type	Autonegotiation	Oper Speed Duplex	Oper Flow Control
1	1000Base-T		Enabled	Down	None	Enabled	1000full	None
2	1000Base-T		Enabled	Down	None	Enabled	1000full	None
3	1000Base-T		Enabled	Down	None	Enabled	1000full	None
4	1000Base-T		Enabled	Down	None	Enabled	1000full	None
5	1000Base-T		Enabled	Up	None	Enabled	100full	None
6	1000Base-T		Enabled	Down	None	Enabled	1000full	None
7	1000Base-T		Enabled	Down	None	Enabled	1000full	None
8	1000Base-T		Enabled	Down	None	Enabled	1000full	None
9	1000Base-T		Enabled	Down	None	Enabled	1000full	None
10	1000Base-T		Enabled	Down	None	Enabled	1000full	None

Configuring Local Port Mirroring

Use the INTERFACE > PORT > MIRROR page to mirror traffic from any source port to a target port for real-time analysis. You can then attach a logic analyzer or RMON probe to the target port and study the traffic crossing the source port in a completely unobtrusive manner.

Figure 6-4. Configuring Local Port Mirroring



CLI References

See Section 30-1: "Local Port Mirroring Commands" on page 30-1 for CLI reference information.

Command Usage

- Traffic can be mirrored from one or more source ports to a destination port on the same switch (local port mirroring as described in this section), or from one or more source ports on remote switches to a destination port on this switch (remote port mirroring as described in "Configuring Remote Port Mirroring" on page 6-9).
- Monitor port speed should match or exceed source port speed, otherwise traffic may be dropped from the monitor port.

- When mirroring port traffic, the target port must be included in the same VLAN as the source port when using MSTP (see Chapter 9: "Spanning Tree Algorithm" on page 9-1).
- When mirroring VLAN traffic (see Section 7-6: "Configuring VLAN Mirroring" on page 7-27) or packets based on a source MAC address (see Section 8-5: "Configuring MAC Address Mirroring" on page 8-6), the target port cannot be set to the same target ports as that used for port mirroring by this command.
- When traffic matches the rules for both port mirroring, and for mirroring of VLAN traffic or packets based on a MAC address, the matching packets will not be sent to target port specified for port mirroring.

Parameters

These parameters are displayed in the web interface:

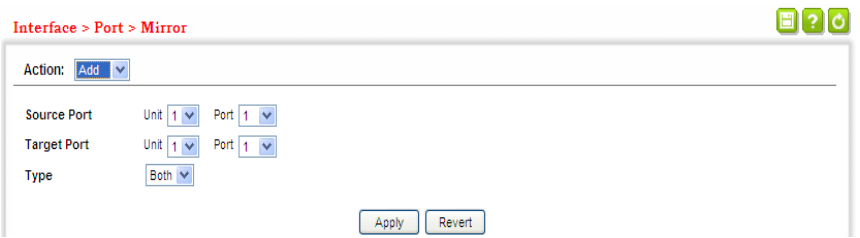
- **Source Port** – The port whose traffic will be monitored. (SSE-G2252/P: 1-52)
- **Target Port** – The port that will mirror the traffic on the source port. (SSE-G2252/P: 1-52)
- **Type** – Allows you to select which traffic to mirror to the target port, Rx (receive), Tx (transmit), or Both. (Default: Rx)

Web Interface

To configure a local mirror session:

1. Click INTERFACE > PORT > MIRROR.
2. Select ADD from the Action List.
3. Specify the source port.
4. Specify the monitor port.
5. Specify the traffic type to be mirrored.
6. Click APPLY.

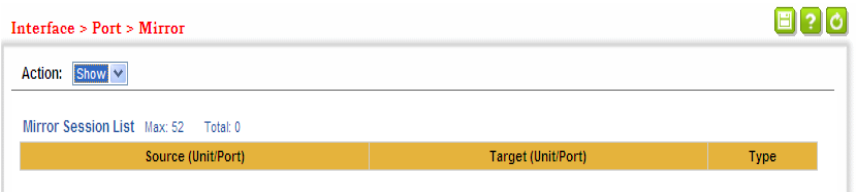
Figure 6-5. Configuring Local Port Mirroring



To display the configured mirror sessions:

1. Click INTERFACE > PORT > MIRROR.
2. Select SHOW from the Action List.

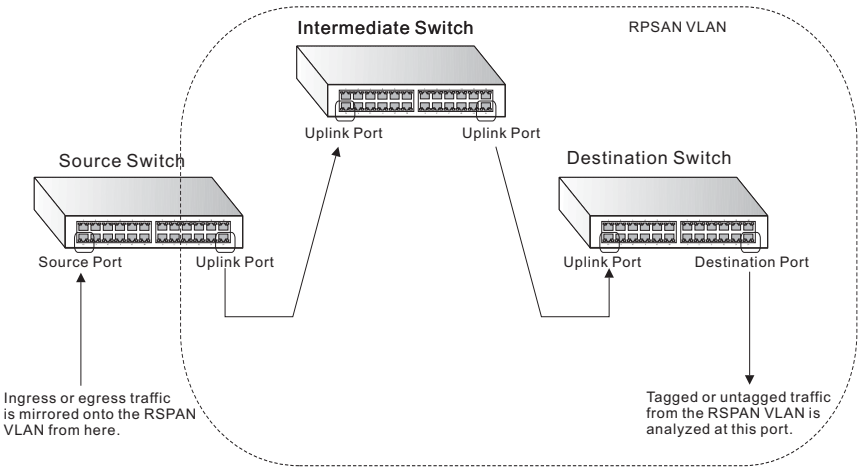
Figure 6-6. Displaying Local Port Mirror Sessions



Configuring Remote Port Mirroring

Use the INTERFACE > PORT > RSPAN page to mirror traffic from remote switches for analysis at a destination port on the local switch. This feature, also called Remote Switched Port Analyzer (RSPAN), carries traffic generated on the specified source ports for each session over a user-specified VLAN dedicated to that RSPAN session in all participating switches. Monitored traffic from one or more sources is copied onto the RSPAN VLAN through IEEE 802.1Q trunk or hybrid ports that carry it to any RSPAN destination port monitoring the RSPAN VLAN as shown in the figure below.

Figure 6-7. Configuring Remote Port Mirroring



CLI References

See Section 30-2: "RSPAN Mirroring Commands" on page 30-5 for CLI reference information.

Command Usage

Traffic can be mirrored from one or more source ports to a destination port on the same switch (local port mirroring as described in "Configuring Local Port Mirroring" on page 6-7), or from one or more source ports on remote switches to a destination port on this switch (remote port mirroring as described in this section).

Configuration Guidelines

Take the following step to configure an RSPAN session:

1. Use the VLAN Static List (see "Configuring VLAN Groups" on page 7-4) to reserve a VLAN for use by RSPAN (marking the "Remote VLAN" field on this page. (Default VLAN 1 is prohibited.)
2. Set up the source switch on the RSPAN configuration page by specifying the mirror session, the switch's role (Source), the RSPAN VLAN, and the uplink port[1]. Then specify the source port(s), and the traffic type to monitor (Rx, Tx or Both).
3. Set up all intermediate switches on the RSPAN configuration page, entering the mirror session, the switch's role (Intermediate), the RSPAN VLAN, and the uplink port(s).
4. Set up the destination switch on the RSPAN configuration page by specifying the mirror session, the switch's role (Destination), the destination port[1], whether or not the traffic exiting this port will be tagged or untagged, and the RSPAN VLAN. Then specify each uplink port where the mirrored traffic is being received.

RSPAN Limitations

The following limitations apply to the use of RSPAN on this switch:

- *RSPAN Ports* – Only ports can be configured as an RSPAN source, destination, or uplink; static and dynamic trunks are not allowed. A port can only be configured as one type of RSPAN interface – source, destination, or uplink. Also, note that the source port and destination port cannot be configured on the same switch.
- *Local/Remote Mirror* – The destination of a local mirror session (created on the INTERFACE > PORT > MIRROR PAGE) cannot be used as the destination for RSPAN traffic.
- *Spanning Tree* – If the spanning tree is disabled, BPDUs will not be flooded onto the RSPAN VLAN.

---

1. Only 802.1Q trunk or hybrid (i.e., general use) ports can be configured as an RSPAN uplink or destination ports – access ports are not allowed (see "Adding Static Members to VLANs" on page 7-6).

- MAC address learning is not supported on RSPAN uplink ports when RSPAN is enabled on the switch. Therefore, even if spanning tree is enabled after RSPAN has been configured, MAC address learning will still not be re-started on the RSPAN uplink ports.
- *IEEE 802.1X* – RSPAN and 802.1X are mutually exclusive functions. When 802.1X is enabled globally, RSPAN uplink ports cannot be configured, even though RSPAN source and destination ports can still be configured. When RSPAN uplink ports are enabled on the switch, 802.1X cannot be enabled globally.
- *Port Security* – If port security is enabled on any port, that port cannot be set as an RSPAN uplink port, even though it can still be configured as an RSPAN source or destination port. Also, when a port is configured as an RSPAN uplink port, port security cannot be enabled on that port.

Parameters

These parameters are displayed in the web interface:

- **Session** – A number identifying this RSPAN session. (Range: 1-2)

  Only two mirror sessions are allowed, including both local and remote mirroring. If local mirroring is enabled (see "Configuring Local Port Mirroring" on page 6-7), then there is only one session available for RSPAN.
- **Operation Status** – Indicates whether or not RSPAN is currently functioning.
- **Switch Role** – Specifies the role this switch performs in mirroring traffic.
  - **None** – This switch will not participate in RSPAN.
  - **Source** - Specifies this device as the source of remotely mirrored traffic.
  - **Intermediate** - Specifies this device as an intermediate switch, transparently passing mirrored traffic from one or more sources to one or more destinations.
  - **Destination** - Specifies this device as a switch configured with a destination port which is to receive mirrored traffic for this session.
- **Remote VLAN** – The VLAN to which traffic mirrored from the source port will be flooded. The VLAN specified in this field must first be reserved for the RSPAN application using the VLAN > STATIC page (see "Configuring VLAN Groups" on page 7-4).
- **Uplink Port** – A port on any switch participating in RSPAN through which mirrored traffic is passed on to or received from the RSPAN VLAN.

  Only one uplink port can be configured on a source switch, but there is no limitation on the number of uplink ports[1] configured on an intermediate or destination switch.

  Only destination and uplink ports will be assigned by the switch as members of the RSPAN VLAN. Ports cannot be manually assigned to an RSPAN VLAN through the VLAN > Static page. Nor can GVRP dynamically add port members to an RSPAN VLAN. Also, note that the VLAN > STATIC (SHOW) page will not display any members for an RSPAN VLAN, but will only show configured RSPAN VLAN identifiers.

- **Type** – Specifies the traffic type to be mirrored remotely. (Options: Rx, Tx, Both)
- **Destination Port** – Specifies the destination port[1] to monitor the traffic mirrored from the source ports. Only one destination port can be configured on the same switch per session, but a destination port can be configured on more than one switch for the same session. Also note that a destination port can still send and receive switched traffic, and participate in any Layer 2 protocols to which it has been assigned.
- **Tag** – Specifies whether or not the traffic exiting the destination port to the monitoring device carries the RSPAN VLAN tag.

Web Interface

To configure a remote mirror session:

1. Click INTERFACE > RSPAN.
2. Set the SWITCH ROLE to NONE, SOURCE, INTERMEDIATE, or DESTINATION.
3. Configure the required settings for each switch participating in the RSPAN VLAN.
4. Click APPLY.

Figure 6-8. Configuring Remote Port Mirroring (Source)

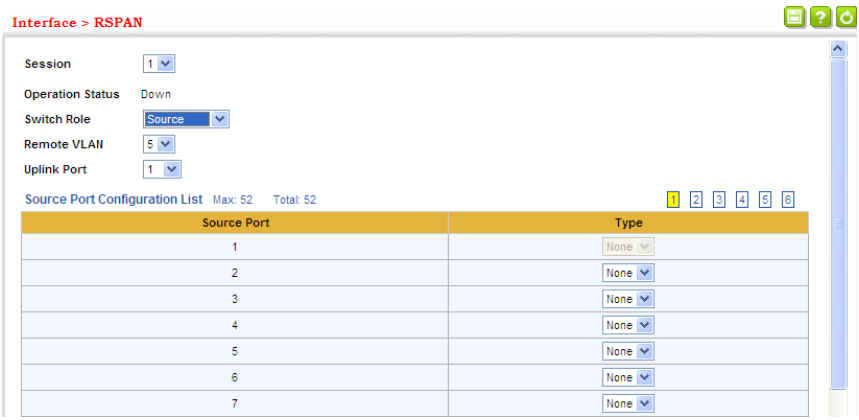


Figure 6-9. Configuring Remote Port Mirroring (Intermediate)

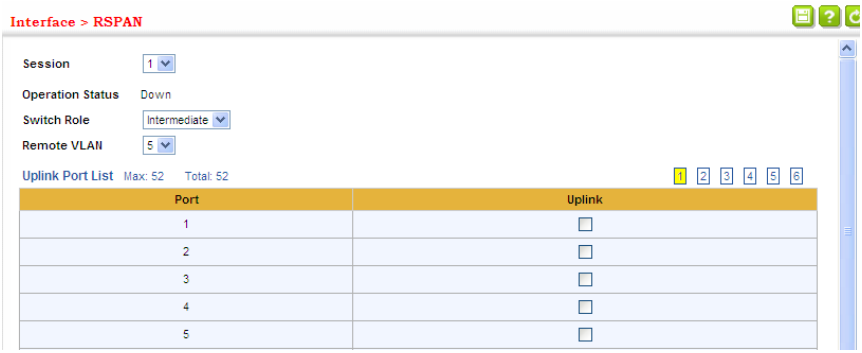
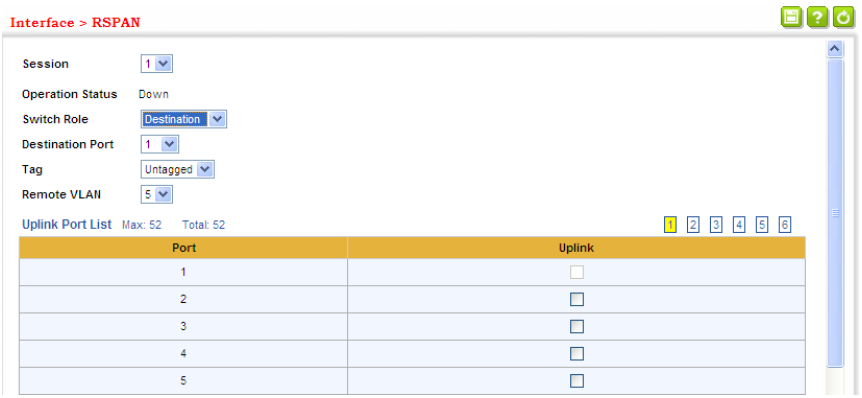


Figure 6-10. Configuring Remote Port Mirroring (Destination)



Showing Port or Trunk Statistics

Use the INTERFACE > PORT/TRUNK > STATISTICS or CHART page to display standard statistics on network traffic from the Interfaces Group and Ethernet-like MIBs, as well as a detailed breakdown of traffic based on the RMON MIB. Interfaces and Ethernet-like statistics display errors on the traffic passing through each port. This information can be used to identify potential problems with the switch (such as a faulty port or unusually heavy loading). RMON statistics provide access to a broad range of statistics, including a total count of different frame types and sizes passing through each port. All values displayed have been accumulated since the last system reboot, and are shown as counts per second. Statistics are refreshed every 60 seconds by default.

NOTE: RMON groups 2, 3 and 9 can only be accessed using SNMP management software.

CLI References

See "show interfaces counters" on page 27-14 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Table 6-1. Port Statistics

Parameter	Description
Interface Statistics	
Received Octets	The total number of octets received on the interface, including framing characters.
Transmitted Octets	The total number of octets transmitted out of the interface, including framing characters.
Received Errors	The number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol.
Transmitted Errors	The number of outbound packets that could not be transmitted because of errors.
Received Unicast Packets	The number of subnetwork-unicast packets delivered to a higher-layer protocol.
Transmitted Unicast Packets	The total number of packets that higher-level protocols requested be transmitted to a subnetwork-unicast address, including those that were discarded or not sent.
Received Discarded Packets	The number of inbound packets which were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol. One possible reason for discarding such a packet could be to free up buffer space.
Transmitted Discarded Packets	The number of outbound packets which were chosen to be discarded even though no errors had been detected to prevent their being transmitted. One possible reason for discarding such a packet could be to free up buffer space.
Received Multicast Packets	The number of packets, delivered by this sub-layer to a higher (sub-)layer, which were addressed to a multicast address at this sub-layer.
Transmitted Multicast Packets	The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a multicast address at this sub-layer, including those that were discarded or not sent.
Received Broadcast Packets	The number of packets, delivered by this sub-layer to a higher (sub-)layer, which were addressed to a broadcast address at this sub-layer.

Table 6-1. Port Statistics (Continued)

Parameter	Description
Transmitted Broadcast Packets	The total number of packets that higher-level protocols requested be transmitted, and which were addressed to a broadcast address at this sub-layer, including those that were discarded or not sent.
Received Unknown Packets	The number of packets received via the interface which were discarded because of an unknown or unsupported protocol.
Etherlike Statistics	
Single Collision Frames	The number of successfully transmitted frames for which transmission is inhibited by exactly one collision.
Multiple Collision Frames	A count of successfully transmitted frames for which transmission is inhibited by more than one collision.
Late Collisions	The number of times that a collision is detected later than 512 bit-times into the transmission of a packet.
Excessive Collisions	A count of frames for which transmission on a particular interface fails due to excessive collisions. This counter does not increment when the interface is operating in full-duplex mode.
Deferred Transmissions	A count of frames for which the first transmission attempt on a particular interface is delayed because the medium was busy.
Frames Too Long	A count of frames received on a particular interface that exceed the maximum permitted frame size.
Alignment Errors	The number of alignment errors (missynchronized data packets).
FCS Errors	A count of frames received on a particular interface that are an integral number of octets in length but do not pass the FCS check. This count does not include frames received with frame-too-long or frame-too-short error.
SQE Test Errors	A count of times that the SQE TEST ERROR message is generated by the PLS sublayer for a particular interface.
Carrier Sense Errors	The number of times that the carrier sense condition was lost or never asserted when attempting to transmit a frame.
Internal MAC Receive Errors	A count of frames for which reception on a particular interface fails due to an internal MAC sublayer receive error.
Internal MAC Transmit Errors	A count of frames for which transmission on a particular interface fails due to an internal MAC sublayer transmit error.
RMON Statistics	
Drop Events	The total number of events in which packets were dropped due to lack of resources.
Jabbers	The total number of frames received that were longer than 1518 octets (excluding framing bits, but including FCS octets), and had either an FCS or alignment error.
Fragments	The total number of frames received that were less than 64 octets in length (excluding framing bits, but including FCS octets) and had either an FCS or alignment error.
Collisions	The best estimate of the total number of collisions on this Ethernet segment.

Table 6-1. Port Statistics (Continued)

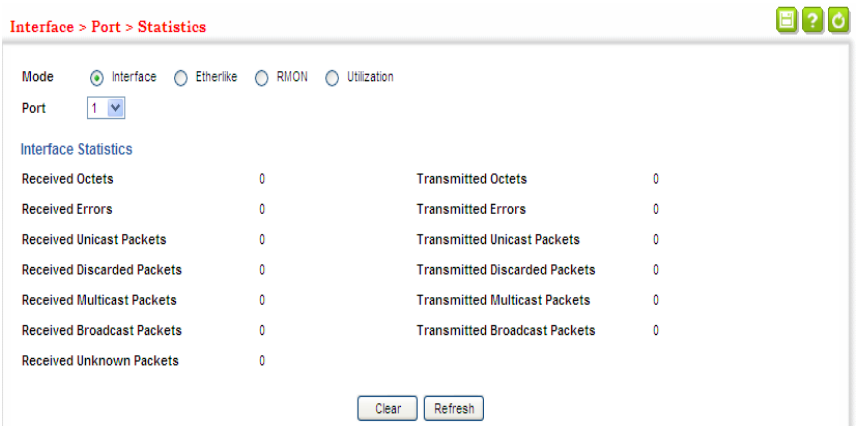
Parameter	Description
Received Octets	Total number of octets of data received on the network. This statistic can be used as a reasonable indication of Ethernet utilization.
Received Packets	The total number of packets (bad, broadcast and multicast) received.
Broadcast Packets	The total number of good packets received that were directed to the broadcast address. Note that this does not include multicast packets.
Multicast Packets	The total number of good packets received that were directed to this multicast address.
Undersize Packets	The total number of packets received that were less than 64 octets long (excluding framing bits, but including FCS octets) and were otherwise well formed.
Oversize Packets	The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets) and were otherwise well formed.
64 Bytes Packets	The total number of packets (including bad packets) received and transmitted that were 64 octets in length (excluding framing bits but including FCS octets).
65-127 Byte Packets 128-255 Byte Packets 256-511 Byte Packets 512-1023 Byte Packets 1024-1518 Byte Packets 1519-1536 Byte Packets	The total number of packets (including bad packets) received and transmitted where the number of octets fall within the specified range (excluding framing bits but including FCS octets).
Utilization Statistics	
Input Octets per second	Number of octets entering this interface per second.
Input Packets per second	Number of packets entering this interface per second.
Input Utilization	The input utilization rate for this interface.
Output Octets per second	Number of octets leaving this interface per second.
Output Packets per second	Number of packets leaving this interface per second.
Output Utilization	The output utilization rate for this interface.

Web Interface

To show a list of port statistics:

1. Click INTERFACE > PORT > STATISTICS.
2. Select the statistics mode to display (Interface, Etherlike, RMON or Utilization).
3. Select a port from the drop-down list.
4. Use the REFRESH button at the bottom of the page if you need to update the screen.

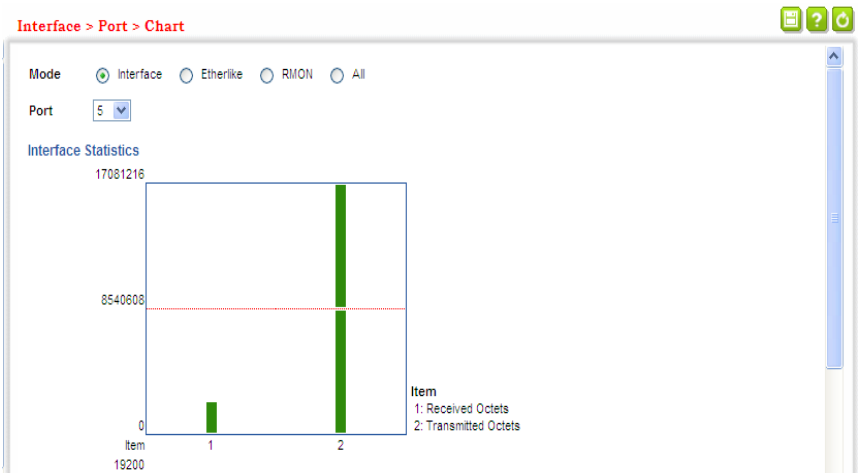
Figure 6-11. Showing Port Statistics (Table)



To show a chart of port statistics:

1. Click INTERFACE > PORT > CHART.
2. Select the statistics mode to display (Interface, Etherlike, RMON or All).
3. If Interface, Etherlike, RMON statistics mode is chosen, select a port from the drop-down list. If All (ports) statistics mode is chosen, select the statistics type to display.

Figure 6-12. Showing Port Statistics (Chart)



Performing Cable Diagnostics

Use the INTERFACE > PORT > CABLE TEST page to test the cable attached to a port. The cable test will check for any cable faults (short, open, etc.). If a fault is found, the switch reports the length to the fault. Otherwise, it reports the cable length. It can be used to determine the quality of the cable, connectors, and terminations. Problems such as opens, shorts, and cable impedance mismatch can be diagnosed with this test.

CLI References

See Chapter 27: "Interface Commands" on page 27-1 for CLI reference information.

Command Usage

- Cable diagnostics are performed using Time Domain Reflectometry (TDR) test methods. TDR analyses the cable by sending a pulsed signal into the cable, and then examining the reflection of that pulse.
- This cable test is only accurate for Fast Ethernet cables 50-140 meters long, and Gigabit Ethernet cables 0 - 250 meters long.
- The test takes approximately 5 seconds. The switch displays the results of the test immediately upon completion, including common cable failures, as well as the status and approximate length to a fault.
- Potential conditions which may be listed by the diagnostics include:
  - OK: Correctly terminated pair
  - Open: Open pair, no link partner
  - Short: Shorted pair
  - Not Supported: This message is displayed for any Fast Ethernet ports that are linked up, or for any Gigabit Ethernet ports linked up at a speed lower than 1000 Mbps.
  - Impedance mismatch: Terminating impedance is not in the reference range.
- Ports are linked down while running cable diagnostics.

Parameters

These parameters are displayed in the web interface:

- **Port** – Switch port identifier. (SSE-G2252/P: 1-52)
- **Type** – Displays media type. (FE – Fast Ethernet, GE – Gigabit Ethernet)
- **Link Status** – Shows if the port link is up or down.
- **Test Result** – The results include common cable failures, as well as the status and approximate distance to a fault, or the approximate cable length if no fault is found.

  To ensure more accurate measurement of the length to a fault, first disable power-saving mode on the link partner before running cable diagnostics.

For link-down ports, the reported distance to a fault is accurate to within +/- 2 meters. For link-up ports, the accuracy is +/- 10 meters.

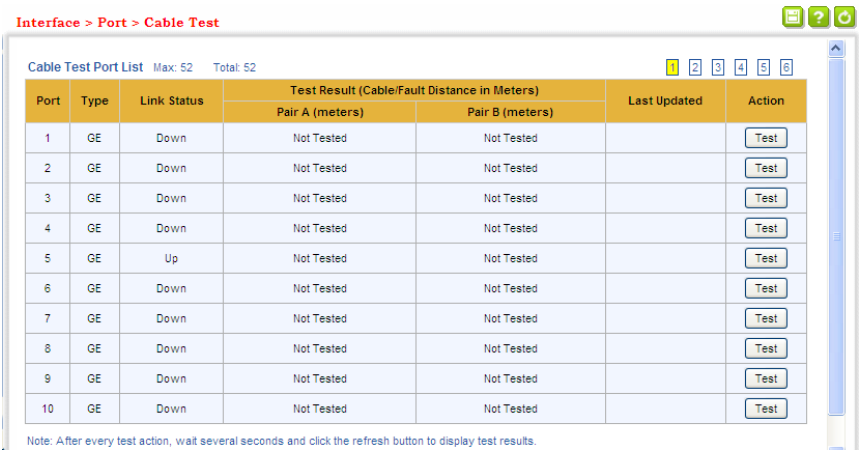
- **Last Updated** – Shows the last time this port was tested.

Web Interface

To test the cable attached to a port:

1. Click INTERFACE > PORT > CABLE TEST.
2. Click TEST for any port to start the cable test.

Figure 6-13. Performing Cable Tests


Interface > Port > Cable Test
Cable Test Port List Max: 52 Total: 52
1 2 3 4 5 6
Port | Type | Link Status | Test Result (Cable/Fault Distance in Meters) | Last Updated | Action
Pair A (meters) | Pair B (meters)
1 GE Down Not Tested Not Tested Test
2 GE Down Not Tested Not Tested Test
3 GE Down Not Tested Not Tested Test
4 GE Down Not Tested Not Tested Test
5 GE Up Not Tested Not Tested Test
6 GE Down Not Tested Not Tested Test
7 GE Down Not Tested Not Tested Test
8 GE Down Not Tested Not Tested Test
9 GE Down Not Tested Not Tested Test
10 GE Down Not Tested Not Tested Test
Note: After every test action, wait several seconds and click the refresh button to display test results.

6-2 Trunk Configuration

This section describes how to configure static and dynamic trunks.

You can create multiple links between devices that work as one virtual, aggregate link. A port trunk offers a dramatic increase in bandwidth for network segments where bottlenecks exist, as well as providing a fault-tolerant link between two devices. You can create up to 12 trunks at a time on the switch.

The switch supports both static trunking and dynamic Link Aggregation Control Protocol (LACP). Static trunks have to be manually configured at both ends of the link, and the switches must comply with the Cisco EtherChannel standard. On the other hand, LACP configured ports can automatically negotiate a trunked link with LACP-configured ports on another device. You can configure any number of ports on the switch as LACP, as long as they are not already configured as part of a static trunk. If ports on another device are also configured as LACP, the switch and the other device will negotiate a trunk link between them. If an LACP trunk consists of more than eight ports, all other ports will be placed in standby mode. Should one link in the trunk fail, one of the standby ports will automatically be activated to replace it.

Command Usage

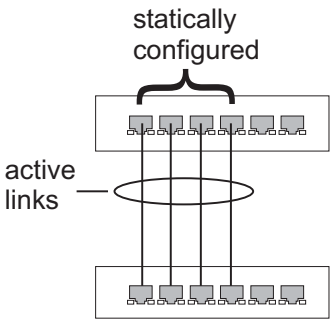
Besides balancing the load across each port in the trunk, the other ports provide redundancy by taking over the load if a port in the trunk fails. However, before making any physical connections between devices, use the web interface or CLI to specify the trunk on the devices at both ends. When using a trunk, take note of the following points:

- Finish configuring trunks before you connect the corresponding network cables between switches to avoid creating a loop.
- You can create up to 12 trunks on a switch, with up to eight ports per trunk.
- The ports at both ends of a connection must be configured as trunk ports.
- When configuring static trunks on switches of different types, they must be compatible with the Cisco EtherChannel standard.
- The ports at both ends of a trunk must be configured in an identical manner, including communication mode (i.e., speed, duplex mode and flow control), VLAN assignments, and CoS settings.
- Any of the Gigabit ports on the front panel can be trunked together, including ports of different media types.
- All the ports in a trunk have to be treated as a whole when moved from/to, added or deleted from a VLAN.
- STP, VLAN, and IGMP settings can only be made for the entire trunk.

Configuring a Static Trunk

Use the INTERFACE > TRUNK > STATIC page to create a trunk, assign member ports, and configure the connection parameters.

Figure 6-14. Configuring Static Trunks



CLI References

See Chapter 28: "Link Aggregation Commands" on page 28-1 and Chapter 27: "Interface Commands" on page 27-1 for CLI reference information.

Command Usage

- When configuring static trunks, you may not be able to link switches of different types, depending on the manufacturer's implementation. However, note that the static trunks on this switch are Cisco EtherChannel compatible.
- To avoid creating a loop in the network, be sure you add a static trunk via the configuration interface before connecting the ports, and also disconnect the ports before removing a static trunk via the configuration interface.

Parameters

These parameters are displayed in the web interface:

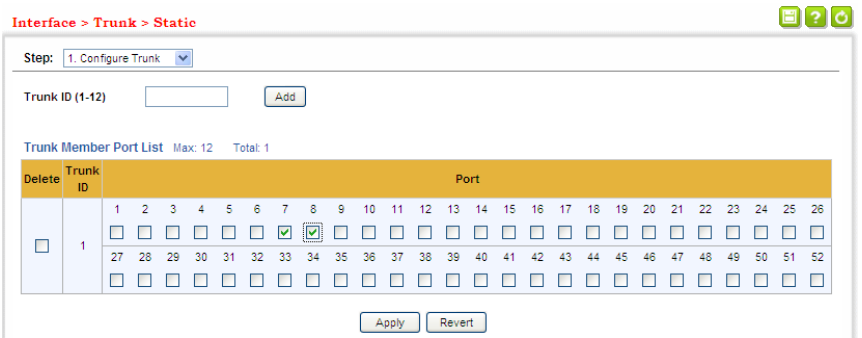
- **Trunk ID** – Trunk identifier. (Range: 1-12)
- **Trunk Member Port List** – The ports assigned to a trunk.

Web Interface

To create a static trunk:

1. Click INTERFACE > TRUNK > STATIC.
2. Select CONFIGURE TRUNK from the Step list.
3. Enter a trunk identifier, and click ADD.
4. Mark the ports assigned to each trunk.
5. Click APPLY.

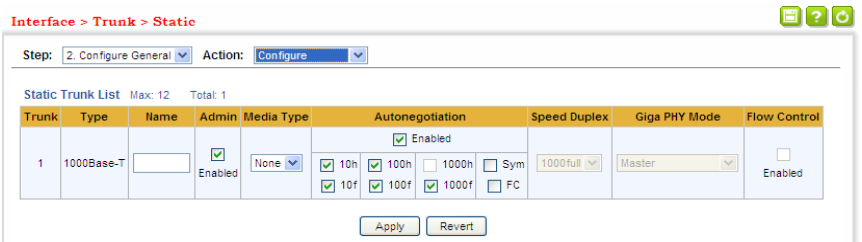
Figure 6-15. Creating Static Trunks



To configure connection parameters for a static trunk:

1. Click INTERFACE > TRUNK > STATIC.
2. Select CONFIGURE GENERAL from the Step list.
3. Select CONFIGURE from the Action list.
4. Modify the required interface settings. (Refer to "Configuring by Port List" on page 6-1 for a description of the parameters.)
5. Click APPLY.

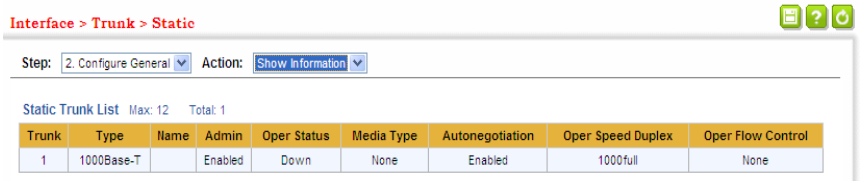
Figure 6-16. Configuring Connection Parameters for a Static Trunk



To show the static trunks configured on the switch:

1. Click INTERFACE > TRUNK > STATIC.
2. Select CONFIGURE GENERAL from the Step list.
3. Select SHOW INFORMATION from the Action list.

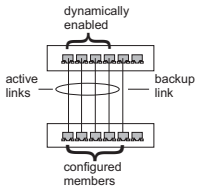
Figure 6-17. Showing Information for Static Trunks



Configuring a Dynamic Trunk

Use the INTERFACE > TRUNK > DYNAMIC (CONFIGURE AGGREGATOR) page to set the administrative key for an aggregation group, enable LACP on a port, and configure protocol parameters for local and partner ports.

Figure 6-18. Configuring Dynamic Trunks



CLI References

See Chapter 28: "Link Aggregation Commands" on page 28-1 for CLI reference information.

Command Usage

- To avoid creating a loop in the network, be sure you enable LACP before connecting the ports, and also disconnect the ports before disabling LACP.
- If the target switch has also enabled LACP on the connected ports, the trunk will be activated automatically.
- A trunk formed with another switch using LACP will automatically be assigned the next available trunk ID.
- If more than eight ports attached to the same target switch have LACP enabled, the additional ports will be placed in standby mode, and will only be enabled if one of the active links fails.
- All ports on both ends of an LACP trunk must be configured for full duplex, and auto-negotiation.

- Ports are only allowed to join the same Link Aggregation Group (LAG) if (1) the LACP port system priority matches, (2) the LACP port admin key matches, and (3) the LAG admin key matches (if configured). However, if the LAG admin key is set, then the port admin key must be set to the same value for a port to be allowed to join that group.

NOTE: If the LACP admin key is not set when a channel group is formed (i.e., it has a null value of 0), the operational value of this key is set to the same value as the port admin key used by the interfaces that joined the group (see the "show lacp" internal command described on page 28-9).

Parameters

These parameters are displayed in the web interface:

Configure Aggregator

- **Admin Key** – LACP administration key is used to identify a specific link aggregation group (LAG) during local LACP setup on the switch. (Range: 0-65535)

Configure Aggregation Port - General

- **Port** – Port identifier. (SSE-G2252/P: 1-52)
- **LACP Status** – Enables or disables LACP on a port.

Configure Aggregation Port - Actor/Partner

- **Port** – Port number. (SSE-G2252/P: 1-52)
- **Admin Key** – The LACP administration key must be set to the same value for ports that belong to the same LAG. (Range: 0-65535; Default: 1)

  By default, the Actor Admin Key is determined by port's link speed, and copied to Oper Key. The Partner Admin Key is assigned to zero, and the Oper Key is set based upon LACP PDUs received from the Partner.
- **System Priority** – LACP system priority is used to determine link aggregation group (LAG) membership, and to identify this device to other switches during LAG negotiations. (Range: 0-65535; Default: 32768)

  System priority is combined with the switch's MAC address to form the LAG identifier. This identifier is used to indicate a specific LAG during LACP negotiations with other systems.
- **Port Priority** – If a link goes down, LACP port priority is used to select a backup link. (Range: 0-65535; Default: 32768)

NOTE: Configuring LACP settings for a port only applies to its administrative state, not its operational state, and will only take effect the next time an aggregate link is established with that port.

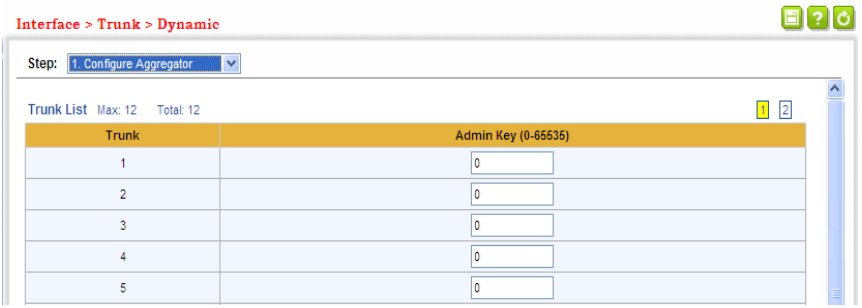
NOTE: Configuring the port partner sets the remote side of an aggregate link; i.e., the ports on the attached device. The command attributes have the same meaning as those used for the port actor.

Web Interface

To configure the admin key for a dynamic trunk:

1. Click INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE AGGREGATOR from the Step list.
3. Set the ADMIN KEY for the required LACP group.
4. Click APPLY.

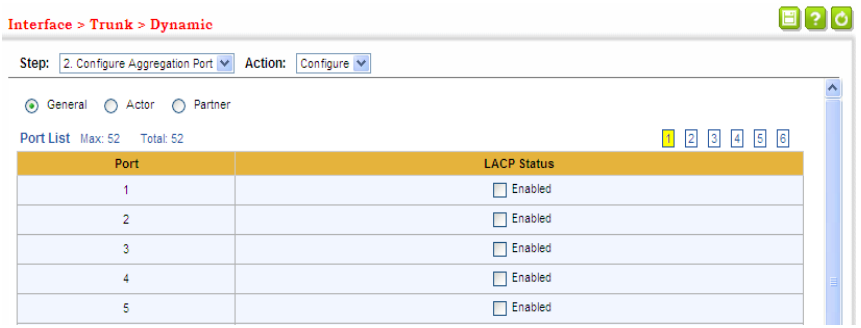
Figure 6-19. Configuring the LACP Aggregator Admin Key



To enable LACP for a port:

1. Click INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE AGGREGATION PORT from the Step list.
3. Select CONFIGURE from the Action list.
4. Click GENERAL.
5. Enable LACP on the required ports.
6. Click APPLY.

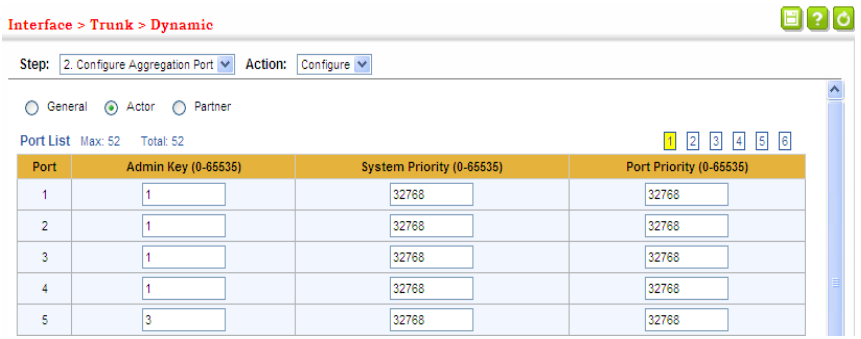
Figure 6-20. Enabling LACP on a Port



To configure LACP parameters for group members:

1. Click INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE AGGREGATION PORT from the Step list.
3. Select CONFIGURE from the Action list.
4. Click ACTOR or PARTNER.
5. Configure the required settings.
6. Click APPLY.

Figure 6-21. Configuring LACP Parameters on a Port

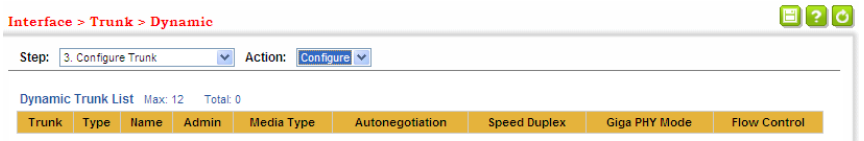


To configure the connection parameters for a dynamic trunk:

1. Click INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE TRUNK from the Step list.
3. Select CONFIGURE from the Action list.

4. Modify the required interface settings. (Refer to "Configuring by Port List" on page 6-1 for a description of the parameters.)
5. Click APPLY.

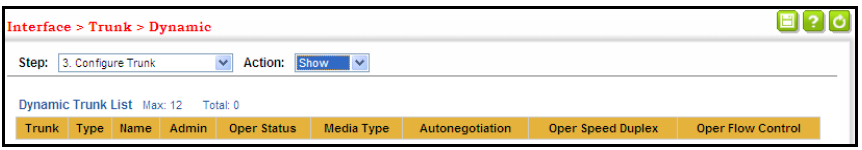
Figure 6-22. Configuring Connection Parameters for a Dynamic Trunk



To show the connection parameters for a dynamic trunk:

1. Click INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE TRUNK from the Step list.
3. Select SHOW from the Action list.

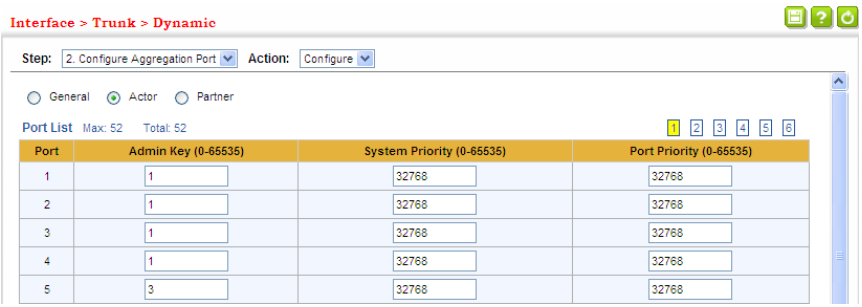
Figure 6-23. Showing Connection Parameters for Dynamic Trunks



To show the port members of dynamic trunks:

1. Click INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE GENERAL from the Step list.
3. Select SHOW MEMBER from the Action list.

Figure 6-24. Showing Members of Dynamic Trunks



Displaying LACP Port Counters

Use the INTERFACE > TRUNK > DYNAMIC (CONFIGURE AGGREGATION PORT - SHOW INFORMATION - COUNTERS) page to display statistics for LACP protocol messages.

CLI References

See "show lacp" on page 28-9 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Table 6-2. LACP Port Counters

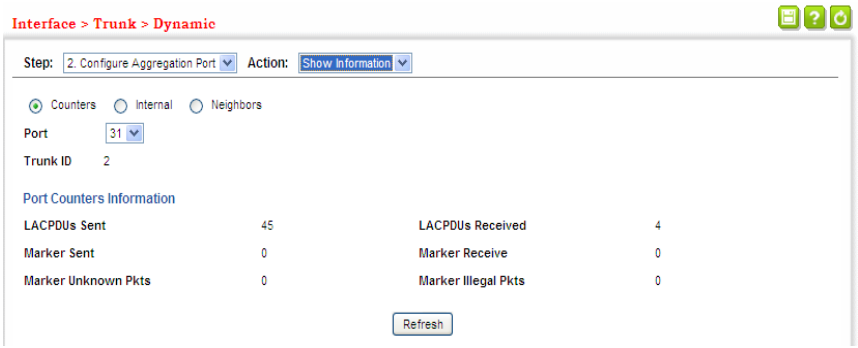
Parameter	Description
LACPDUs Sent	Number of valid LACPDUs transmitted from this channel group.
LACPDUs Received	Number of valid LACPDUs received on this channel group.
Marker Sent	Number of valid Marker PDUs transmitted from this channel group.
Marker Received	Number of valid Marker PDUs received by this channel group.
Marker Unknown Pkts	Number of frames received that either (1) Carry the Slow Protocols Ethernet Type value, but contain an unknown PDU, or (2) are addressed to the Slow Protocols group MAC Address, but do not carry the Slow Protocols Ethernet Type.
Marker Illegal Pkts	Number of frames that carry the Slow Protocols Ethernet Type value, but contain a badly formed PDU or an illegal value of Protocol Subtype.

Web Interface

To display LACP port counters:

1. Click INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE AGGREGATION PORT from the Step list.
3. Select SHOW INFORMATION from the Action list.
4. Click COUNTERS.
5. Select a group member from the Port list.

Figure 6-25. Displaying LACP Port Counters



Displaying LACP Settings and Status for the Local Side

Use the INTERFACE > TRUNK > DYNAMIC (CONFIGURE AGGREGATION PORT - SHOW INFORMATION - INTERNAL) page to display the configuration settings and operational state for the local side of a link aggregation.

CLI References

See "show lacp" on page 28-9 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Table 6-3. LACP Internal Configuration Information

Parameter	Description
LACP System Priority	LACP system priority assigned to this port channel.
LACP Port Priority	LACP port priority assigned to this interface within the channel group.
Admin Key	Current administrative value of the key for the aggregation port.
Oper Key	Current operational value of the key for the aggregation port.

Table 6-3. LACP Internal Configuration Information (Continued)

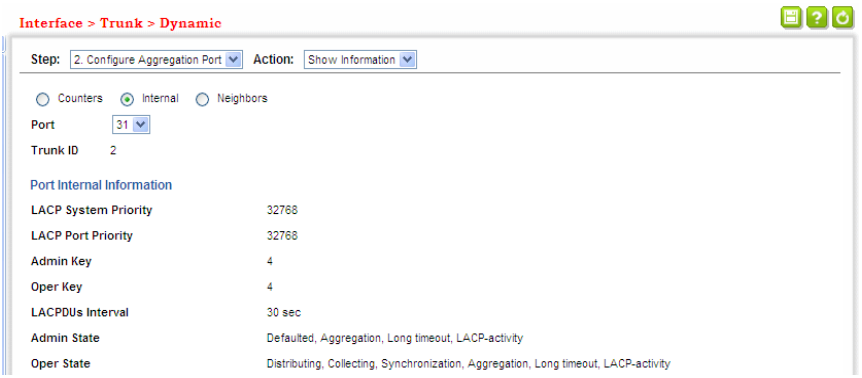
Parameter	Description
LACPDUs Interval	Number of seconds before invalidating received LACPDU information.
Admin State, Oper State	Administrative or operational values of the actor's state parameters: Expired – The actor's receive machine is in the expired state; Defaulted – The actor's receive machine is using defaulted operational partner information, administratively configured for the partner. Distributing – If false, distribution of outgoing frames on this link is disabled; i.e., distribution is currently disabled and is not expected to be enabled in the absence of administrative changes or changes in received protocol information. Collecting – Collection of incoming frames on this link is enabled; i.e., collection is currently enabled and is not expected to be disabled in the absence of administrative changes or changes in received protocol information. Synchronization – The System considers this link to be IN_SYNC; i.e., it has been allocated to the correct Link Aggregation Group, the group has been associated with a compatible Aggregator, and the identity of the Link Aggregation Group is consistent with the System ID and operational Key information transmitted. Aggregation – The system considers this link to be aggregatable; i.e., a potential candidate for aggregation. Long timeout – Periodic transmission of LACPDUs uses a slow transmission rate. LACP-Activity – Activity control value with regard to this link. (0: Passive; 1: Active)

Web Interface

To display LACP settings and status for the local side:

1. Click INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE AGGREGATION PORT from the Step list.
3. Select SHOW INFORMATION from the Action list.
4. Click INTERNAL.
5. Select a group member from the Port list.

Figure 6-26. Displaying LACP Port Internal Information



Displaying LACP Settings and Status for the Remote Side

Use the INTERFACE > TRUNK > DYNAMIC (CONFIGURE AGGREGATION PORT - SHOW INFORMATION - NEIGHBORS) page to display the configuration settings and operational state for the remote side of a link aggregation.

CLI References

See "show lacp" on page 28-9 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Table 6-4. LACP Internal Configuration Information

Parameter	Description
Partner Admin System ID	LAG partner's system ID assigned by the user.
Partner Oper System ID	LAG partner's system ID assigned by the LACP protocol.
Partner Admin Port Number	Current administrative value of the port number for the protocol Partner.
Partner Oper Port Number	Operational port number assigned to this aggregation port by the port's protocol partner.
Port Admin Priority	Current administrative value of the port priority for the protocol partner.
Port Oper Priority	Priority value assigned to this aggregation port by the partner.
Admin Key	Current administrative value of the Key for the protocol partner.
Oper Key	Current operational value of the Key for the protocol partner.

Table 6-4. LACP Internal Configuration Information (Continued)

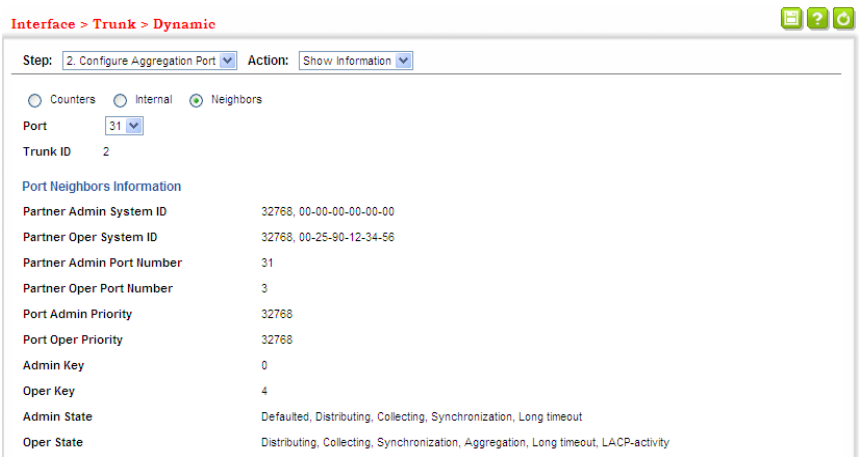
Parameter	Description
Admin State	Administrative values of the partner's state parameters. (See preceding table.)
Oper State	Operational values of the partner's state parameters. (See preceding table.)

Web Interface

To display LACP settings and status for the remote side:

1. INTERFACE > TRUNK > DYNAMIC.
2. Select CONFIGURE AGGREGATION PORT from the Step list.
3. Select SHOW INFORMATION from the Action list.
4. Click INTERNAL.
5. Select a group member from the Port list.

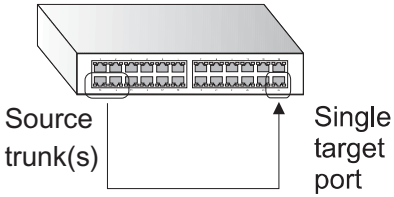
Figure 6-27. Displaying LACP Port Remote Information


Interface > Trunk > Dynamic
Step: 2. Configure Aggregation Port
Action: Show Information
Counters
Internal
Neighbors
Port 31
Trunk ID 2
Port Neighbors Information
Partner Admin System ID 32768, 00-00-00-00-00-00
Partner Oper System ID 32768, 00-25-90-12-34-56
Partner Admin Port Number 31
Partner Oper Port Number 3
Port Admin Priority 32768
Port Oper Priority 32768
Admin Key 0
Oper Key 4
Admin State Defaulted, Distributing, Collecting, Synchronization, Long timeout
Oper State Distributing, Collecting, Synchronization, Aggregation, Long timeout, LACP-activity

Configuring Trunk Mirroring

Use the INTERFACE > TRUNK > MIRROR page to mirror traffic from any source trunk to a target port for real-time analysis. You can then attach a logic analyzer or RMON probe to the target port and study the traffic crossing the source trunk in a completely unobtrusive manner.

Figure 6-28. Configuring Trunk Mirroring



CLI References

See Section 30-1: "Local Port Mirroring Commands" on page 30-1 for CLI reference information.

Command Usage

- Traffic can be mirrored from one or more source trunks to a destination port on the same switch.
- Monitor port speed should match or exceed source trunk speed, otherwise traffic may be dropped from the monitor port.
- When mirroring trunk traffic, the target port must be included in the same VLAN as the source trunk when using MSTP (see Chapter 9: "Spanning Tree Algorithm" on page 9-1).
- When mirroring VLAN traffic (see Section 7-6: "Configuring VLAN Mirroring" on page 7-27) or packets based on a source MAC address (see Section 8-5: "Configuring MAC Address Mirroring" on page 8-6), the target port cannot be set to the same target port as that used for trunk mirroring by this command.
- When traffic matches the rules for both trunk mirroring, and for mirroring of VLAN traffic or packets based on a MAC address, the matching packets will not be sent to target port specified for trunk mirroring.

Parameters

These parameters are displayed in the web interface:

- **Source Trunk** – The trunk whose traffic will be monitored.
  (Range: 1-12)
- **Target Port** – The port that will mirror the traffic on the source trunk.
  (SSE-G2252/P: 1-52)
- **Type** – Allows you to select which traffic to mirror to the target port, Rx (receive), Tx (transmit), or Both. (Default: Both)

Web Interface

To configure a local mirror session:

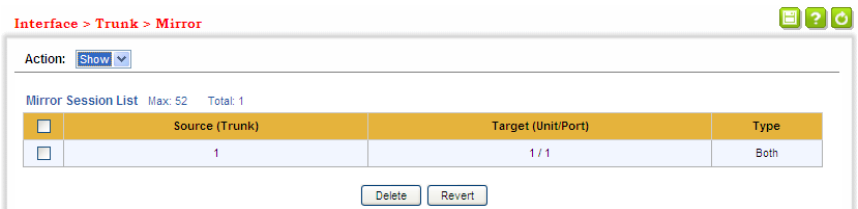
1. Click INTERFACE > TRUNK > MIRROR
2. Select ADD from the Action List.
3. Specify the source trunk.
4. Specify the monitor port.
5. Specify the traffic type to be mirrored.
6. Click APPLY.

Figure 6-29. Configuring Trunk Mirroring

To display the configured mirror sessions:

1. Click INTERFACE > TRUNK > MIRROR.
2. Select SHOW from the Action List.

Figure 6-30. Displaying Trunk Mirror Sessions



6-3 Saving Power

Use the INTERFACE > GREEN ETHERNET page to enable power savings mode on the selected port.

CLI References

See "power-save" on page 27-22 and "show power-save" on page 27-24 for CLI reference information.

Command Usage

- IEEE 802.3 defines the Ethernet standard and subsequent power requirements based on cable connections operating at 100 meters. Enabling power saving mode can reduce power used for cable lengths of 60 meters or less, with more significant reduction for cables of 20 meters or less, and continue to ensure signal integrity.
- The power-saving methods provided by this switch include:
  - Power saving when there is no link partner:

    Under normal operation, the switch continuously auto-negotiates to find a link partner, keeping the MAC interface powered up even if no link connection exists. When using power-savings mode, the switch checks for energy on the circuit to determine if there is a link partner. If none is detected, the switch automatically turns off the transmitter, and most of the receive circuitry (entering Sleep Mode). In this mode, the low-power energy-detection circuit continuously checks for energy on the cable. If none is detected, the MAC interface is also powered down to save additional energy. If energy is detected, the switch immediately turns on both the transmitter and receiver functions, and powers up the MAC interface.
  - Power saving when there is a link partner:

    Traditional Ethernet connections typically operate with enough power to support at least 100 meters of cable even though average network cable length is shorter. When cable length is shorter, power consumption can be reduced since signal attenuation is proportional to cable length. When power-savings mode is enabled, the switch analyzes cable length to determine whether or not it can reduce the signal amplitude used on a particular link.

NOTE: Power savings can only be implemented on Gigabit Ethernet ports when using twisted-pair cabling. Power-savings mode on a active link only works when connection speed is 1 Gbps, and line length is less than 60 meters.

Parameters

These parameters are displayed in the web interface:

- **Port** – Power saving mode only applies to the Gigabit Ethernet ports using copper media.
- **Power Saving Status** – Adjusts the power provided to ports based on the length of the cable used to connect to other devices. Only sufficient power is used to maintain connection requirements. (Default: Enabled on Gigabit Ethernet RJ-45 ports)

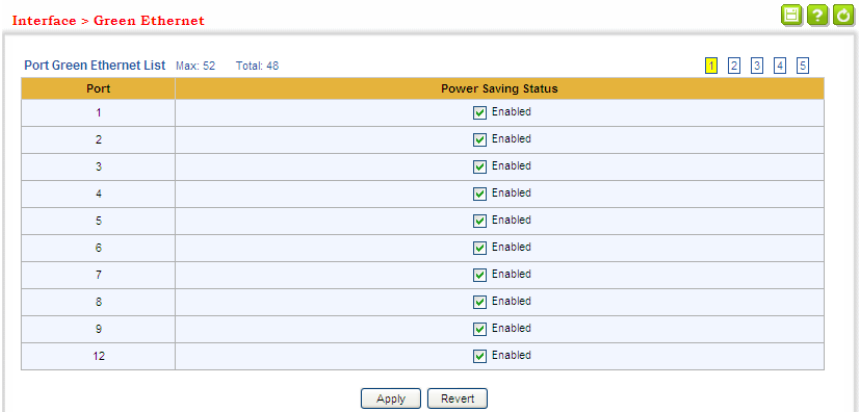
Web Interface

To enable power savings:

1. Click INTERFACE > GREEN ETHERNET.
2. Mark the ENABLED check box for a port.

3. Click APPLY.

Figure 6-31. Enabling Power Savings



6-4 Traffic Segmentation

If tighter security is required for passing traffic from different clients through downlink ports on the local network and over uplink ports to the service provider, port-based traffic segmentation can be used to isolate traffic between clients on different downlink ports. Data traffic on downlink ports is only forwarded to, and from, uplink ports.

Enabling Traffic Segmentation

Use the INTERFACE > TRAFFIC SEGMENTATION (CONFIGURE GLOBAL) page to enable traffic segmentation.

CLI References

See Section 35-6: "Configuring Port-based Traffic Segmentation" on page 35-24 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Status** – Enables port-based traffic segmentation. (Default: Disabled)

Web Interface

To enable traffic segmentation:

1. Click INTERFACE > TRAFFIC SEGMENTATION.
2. Select CONFIGURE GLOBAL from the Step list.
3. Mark the ENABLED check box.
4. Click APPLY.

Figure 6-32. Enabling Traffic Segmentation

Configuring Uplink and Downlink Ports

Use the INTERFACE > TRAFFIC SEGMENTATION (CONFIGURE SESSION) page to assign the downlink and uplink ports to use in the segmented group. Ports designated as downlink ports can not communicate with any other ports on the switch except for the uplink ports. Uplink ports can communicate with any other ports on the switch and with any designated downlink ports.

CLI References

See Section 35-6: "Configuring Port-based Traffic Segmentation" on page 35-24 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Interface** – Displays a list of ports or trunks.
- **Port** – Port Identifier. (SSE-G2252/P: 1-52)
- **Trunk** – Trunk Identifier. (Range: 1-12)
- **Direction** – Adds an interface to the segmented group by setting the direction to uplink or downlink. (Default: None)

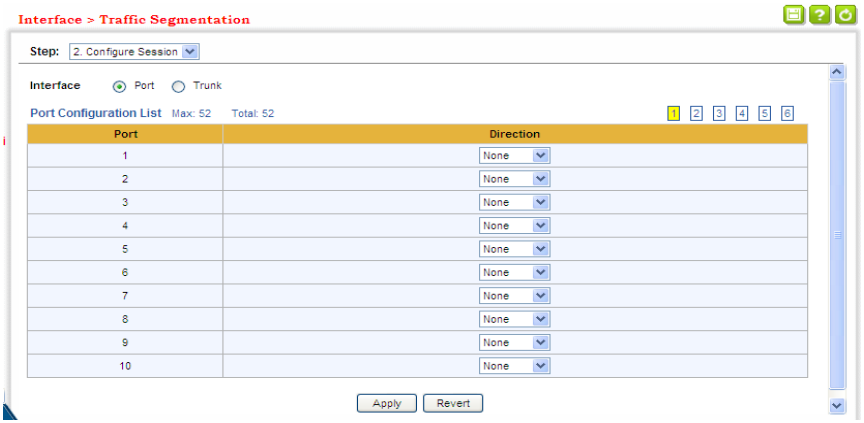
Web Interface

To configure the members of the traffic segmentation group:

1. Click INTERFACE > TRAFFIC SEGMENTATION
2. Select CONFIGURE SESSION from the Step list.

3. Click PORT or TRUNK to specify the interface type.
4. Select UPLINK or DOWNLINK in the Direction list to add a group member.
5. Click APPLY.

Figure 6-33. Configuring Members for Traffic Segmentation



6-5 VLAN Trunking

Use the INTERFACE > VLAN TRUNKING page to allow unknown VLAN groups to pass through the specified interface.

CLI References

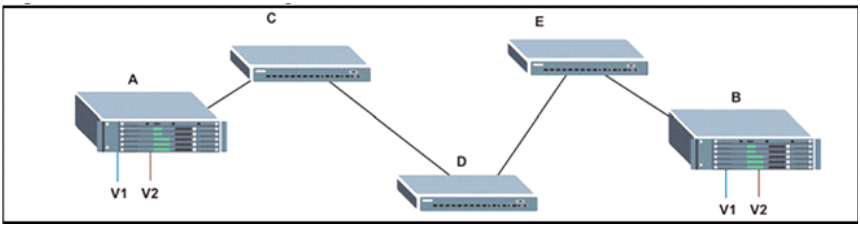
See "vlan-trunking" on page 35-17 for CLI reference information.

Command Usage

- Use this feature to configure a tunnel across one or more intermediate switches which pass traffic for VLAN groups to which they do not belong.

  The following figure shows VLANs 1 and 2 configured on switches A and B, with VLAN trunking being used to pass traffic for these VLAN groups across switches C, D and E.

Figure 6-34. Configuring VLAN Trunking



Without VLAN trunking, you would have to configure VLANs 1 and 2 on all intermediate switches – C, D and E; otherwise these switches would drop any frames with unknown VLAN group tags. However, by enabling VLAN trunking on the intermediate switch ports along the path connecting VLANs 1 and 2, you only need to create these VLAN groups in switches A and B. Switches C, D and E automatically allow frames with VLAN group tags 1 and 2 (groups that are unknown to those switches) to pass through their VLAN trunking ports.

- VLAN trunking is mutually exclusive with the “access” switchport mode (see "Adding Static Members to VLANs" on page 7-6). If VLAN trunking is enabled on an interface, then that interface cannot be set to access mode, and vice versa.
- To prevent loops from forming in the spanning tree, all unknown VLANs will be bound to a single instance (either STP/RSTP or an MSTP instance, depending on the selected STA mode).
- If both VLAN trunking and ingress filtering are disabled on an interface, packets with unknown VLAN tags will still be allowed to enter this interface and will be flooded to all other ports where VLAN trunking is enabled. (In other words, VLAN trunking will still be effectively enabled for the unknown VLAN).

Parameters

These parameters are displayed in the web interface:

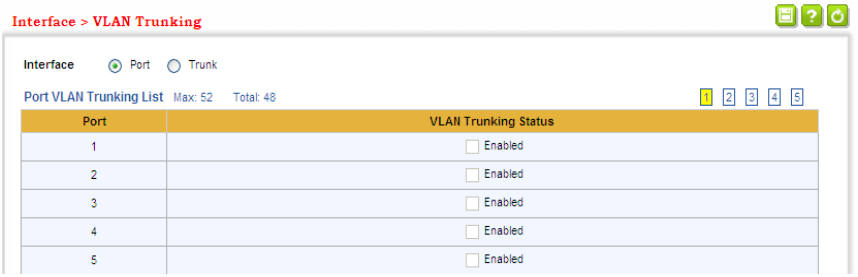
- **Interface** – Displays a list of ports or trunks.
- **Port** – Port Identifier. (SSE-G2252/P: 1-52)
- **Trunk** – Trunk Identifier. (Range: 1-12)
- **VLAN Trunking Status** – Enables VLAN trunking on the selected interface.

Web Interface

To enable VLAN trunking on a port or trunk:

1. Click INTERFACE > VLAN TRUNKING.
2. Click PORT or TRUNK to specify the interface type.
3. Enable VLAN trunking on any of the ports or on a trunk.
4. Click APPLY.

Figure 6-35. Configuring VLAN Trunking



Chapter 7
VLAN Configuration

This chapter includes the following topics:

- IEEE 802.1Q VLANs – Configures static and dynamic VLANs.
- IEEE 802.1Q Tunneling – Configures QinQ tunneling to maintain customer-specific VLAN and Layer 2 protocol configurations across a service provider network, even when different customers use the same internal VLAN IDs.
- Protocol VLANs – Configures VLAN groups based on specified protocols.
- Configuring IP Subnet VLANs – Maps untagged ingress frames to a specified VLAN if the source address is found in the IP subnet-to-VLAN mapping table.
- Configuring MAC-based VLANs – Maps untagged ingress frames to a specified VLAN if the source MAC address is found in the IP MAC address-to-VLAN mapping table.
- Configuring VLAN Mirroring – Mirrors traffic from one or more source VLANs to a target port.

7-1 IEEE 802.1Q VLANs

In large networks, routers are used to isolate broadcast traffic for each subnet into separate domains. This switch provides a similar service at Layer 2 by using VLANs to organize any group of network nodes into separate broadcast domains. VLANs confine broadcast traffic to the originating group, and can eliminate broadcast storms in large networks. This also provides a more secure and cleaner network environment.

An IEEE 802.1Q VLAN is a group of ports that can be located anywhere in the network, but communicate as though they belong to the same physical segment.

VLANs help to simplify network management by allowing you to move devices to a new VLAN without having to change any physical connections. VLANs can be easily organized to reflect departmental groups (such as Marketing or R&D), usage groups (such as e-mail), or multicast groups (used for multimedia applications such as video conferencing).

VLANs provide greater network efficiency by reducing broadcast traffic, and allow you to make network changes without having to update IP addresses or IP subnets. VLANs inherently provide a high level of network security since traffic must pass through a configured Layer 3 link to reach a different VLAN.

This switch supports the following VLAN features:

- Up to 256 VLANs based on the IEEE 802.1Q standard
- Distributed VLAN learning across multiple switches using explicit or implicit tagging and GVRP protocol

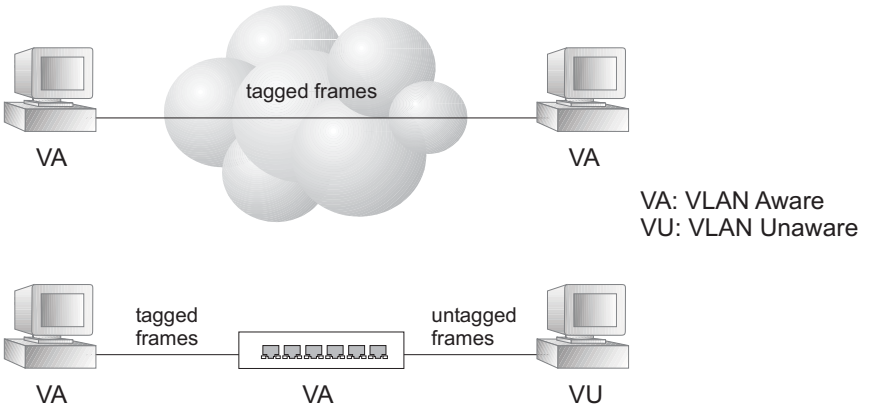
- Port overlapping, allowing a port to participate in multiple VLANs
- End stations can belong to multiple VLANs
- Passing traffic between VLAN-aware and VLAN-unaware devices
- Priority tagging

Assigning Ports to VLANs

Before enabling VLANs for the switch, you must first assign each port to the VLAN group(s) in which it will participate. By default all ports are assigned to VLAN 1 as untagged ports. Add a port as a tagged port if you want it to carry traffic for one or more VLANs, and any intermediate network devices or the host at the other end of the connection supports VLANs. Then assign ports on the other VLAN-aware network devices along the path that will carry this traffic to the same VLAN(s), either manually or dynamically using GVRP. However, if you want a port on this switch to participate in one or more VLANs, but none of the intermediate network devices nor the host at the other end of the connection supports VLANs, then you should add this port to the VLAN as an untagged port.

NOTE: VLAN-tagged frames can pass through VLAN-aware or VLAN-unaware network interconnection devices, but the VLAN tags should be stripped off before passing it on to any end-node host that does not support VLAN tagging.

Figure 7-1. VLAN Compliant and VLAN Non-compliant Devices



VLAN Classification

When the switch receives a frame, it classifies the frame in one of two ways. If the frame is untagged, the switch assigns the frame to an associated VLAN (based on the default VLAN ID of the receiving port). But if the frame is tagged, the switch uses the tagged VLAN ID to identify the port broadcast domain of the frame.

Port Overlapping

Port overlapping can be used to allow access to commonly shared network resources among different VLAN groups, such as file servers or printers. Note that if you implement VLANs which do not overlap, but still need to communicate, you can connect them by enabled routing on this switch.

Untagged VLANs

Untagged VLANs are typically used to reduce broadcast traffic and to increase security. A group of network users assigned to a VLAN form a broadcast domain that is separate from other VLANs configured on the switch. Packets are forwarded only between ports that are designated for the same VLAN. Untagged VLANs can be used to manually isolate user groups or subnets. However, you should use IEEE 802.3 tagged VLANs with GVRP whenever possible to fully automate VLAN registration.

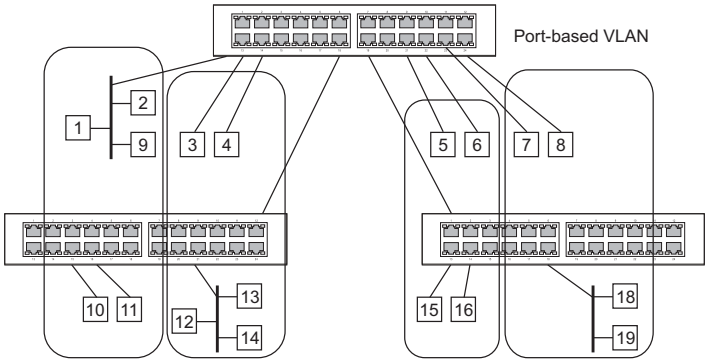
Automatic VLAN Registration

GVRP (GARP VLAN Registration Protocol) defines a system whereby the switch can automatically learn the VLANs to which each end station should be assigned. If an end station (or its network adapter) supports the IEEE 802.1Q VLAN protocol, it can be configured to broadcast a message to your network indicating the VLAN groups it wants to join. When this switch receives these messages, it will automatically place the receiving port in the specified VLANs, and then forward the message to all other ports. When the message arrives at another switch that supports GVRP, it will also place the receiving port in the specified VLANs, and pass the message on to all other ports. VLAN requirements are propagated in this way throughout the network. This allows GVRP-compliant devices to be automatically configured for VLAN groups based solely on end station requests.

To implement GVRP in a network, first add the host devices to the required VLANs (using the operating system or other application software), so that these VLANs can be propagated onto the network. For both the edge switches attached directly to these hosts, and core switches in the network, enable GVRP on the links between these devices. You should also determine security boundaries in the network and disable GVRP on the boundary ports to prevent advertisements from being propagated, or forbid those ports from joining restricted VLANs.

NOTE: If you have host devices that do not support GVRP, you should configure static or untagged VLANs for the switch ports connected to these devices (as described in "Adding Static Members to VLANs" on page 7-6). But you can still enable GVRP on these edge switches, as well as on the core switches in the network.

Figure 7-2. Using GVRP



Forwarding Tagged/Untagged Frames

If you want to create a small port-based VLAN for devices attached directly to a single switch, you can assign ports to the same untagged VLAN. However, to participate in a VLAN group that crosses several switches, you should create a VLAN for that group and enable tagging on all ports.

Ports can be assigned to multiple tagged or untagged VLANs. Each port on the switch is therefore capable of passing tagged or untagged frames. When forwarding a frame from this switch along a path that contains any VLAN-aware devices, the switch should include VLAN tags. When forwarding a frame from this switch along a path that does not contain any VLAN-aware devices (including the destination host), the switch must first strip off the VLAN tag before forwarding the frame. When the switch receives a tagged frame, it will pass this frame onto the VLAN(s) indicated by the frame tag. However, when this switch receives an untagged frame from a VLAN-unaware device, it first decides where to forward the frame, and then inserts a VLAN tag reflecting the ingress port's default VID.

Configuring VLAN Groups

Use the VLAN > STATIC (CONFIGURE VLAN) page to create or remove VLAN groups, set administrative status, or specify Remote VLAN type (see "Configuring Remote Port Mirroring" on page 6-9). To propagate information about VLAN groups used on this switch to external network devices, you must specify a VLAN ID for each of these groups.

CLI References

See Section 35-2: "Editing VLAN Groups" on page 35-8 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **VLAN ID** – ID of VLAN or range of VLANs (1-4093).

  Up to 256 VLAN groups can be defined. VLAN 1 is the default untagged VLAN.

  VLAN 4093 is dedicated for Switch Clustering. Configuring this VLAN for other purposes may cause problems in the Clustering operation.

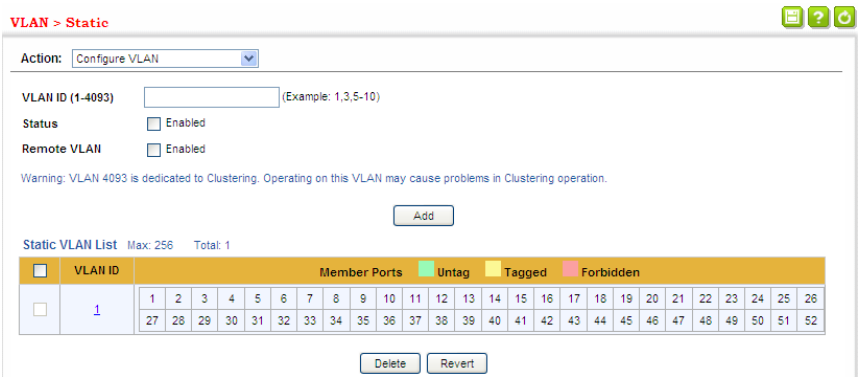
- **Status** – Enables or disables the specified VLAN.
- **Remote VLAN** – Reserves this VLAN for RSPAN (see "Configuring Remote Port Mirroring" on page 6-9).

Web Interface

To create VLAN groups:

1. Click VLAN > STATIC.
2. Select CONFIGURE VLAN from the Action list.
3. Enter a VLAN ID or range of IDs.
4. Mark ENABLED to configure the VLAN as operational.
5. Mark REMOTE VLAN to use it for RSPAN.
6. Click ADD.

Figure 7-3. Creating Static VLANs


VLAN > Static
Action: Configure VLAN
VLAN ID (1-4093)
(Example: 1,3,5-10)
Status
Enabled
Remote VLAN
Enabled
Warning: VLAN 4093 is dedicated to Clustering. Operating on this VLAN may cause problems in Clustering operation.
Add
Static VLAN List Max: 256 Total: 1
VLAN ID
Member Ports
Untag
Tagged
Forbidden
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
Delete
Revert

Adding Static Members to VLANs

Use the VLAN > STATIC (MODIFY VLAN AND MEMBER PORTS, EDIT MEMBER BY INTERFACE, OR EDIT MEMBER BY INTERFACE RANGE) pages to configure port members for the selected VLAN index, interface, or a range of interfaces. Use the menus for editing port members to configure the VLAN behavior for specific interfaces, including the mode of operation (Hybrid or 1Q Trunk), the default VLAN identifier (PVID), accepted frame types, and ingress filtering. Assign ports as tagged if they are connected to 802.1Q VLAN compliant devices, or untagged they are not connected to any VLAN-aware devices. Or configure a port as forbidden to prevent the switch from automatically adding it to a VLAN via the GVRP protocol.

CLI References

See Section 35-3: "Configuring VLAN Interfaces" on page 35-10 and Section 35-4: "Displaying VLAN Information" on page 35-18 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Modify VLAN and Member Ports

- **VLAN** – ID of configured VLAN (1-4094).
- **VLAN Name** – Name of the VLAN (1 to 32 characters).
- **Status** – Enables or disables the specified VLAN.
- **Remote VLAN** – Shows if RSPAN is enabled on this VLAN (see "Configuring VLAN Groups" on page 7-4.
- **Interface** – Displays a list of ports or trunks.
- **Port** – Port Identifier. (SSE-G2252/P: 1-52)
- **Trunk** – Trunk Identifier. (Range: 1-12)
- **Mode** – Indicates VLAN membership mode for an interface. (Default: Access)
  - **Access** - Sets the port to operate as an untagged interface. The port transmits and receives untagged frames on a single VLAN only.

    Access mode is mutually exclusive with VLAN trunking (see Section 6-5: "VLAN Trunking" on page 6-38). If VLAN trunking is enabled on an interface, then that interface cannot be set to access mode, and vice versa.
  - **Hybrid** – Specifies a hybrid VLAN interface. The port may transmit tagged or untagged frames.
  - **1Q Trunk** – Specifies a port as an end-point for a VLAN trunk. A trunk is a direct link between two switches, so the port transmits tagged frames that identify the source VLAN. Note that frames belonging to the port's default VLAN (i.e., associated with the PVID) are also transmitted as tagged frames.

- **PVID** – VLAN ID assigned to untagged frames received on the interface. (Default: 1)

  When using Access mode, and an interface is assigned to a new VLAN, its PVID is automatically set to the identifier for that VLAN. When using Hybrid mode, the PVID for an interface can be set to any VLAN for which it is an untagged member.

- **Acceptable Frame Type** – Sets the interface to accept all frame types, including tagged or untagged frames, or only tagged frames. When set to receive all frame types, any received frames that are untagged are assigned to the default VLAN. (Options: All, Tagged; Default: All)

- **Ingress Filtering** – Determines how to process frames tagged for VLANs for which the ingress port is not a member. (Default: Disabled)

  - Ingress filtering only affects tagged frames.
  - If ingress filtering is disabled and a port receives frames tagged for VLANs for which it is not a member, these frames will be flooded to all other ports (except for those VLANs explicitly forbidden on this port).
  - If ingress filtering is enabled and a port receives frames tagged for VLANs for which it is not a member, these frames will be discarded.
  - Ingress filtering does not affect VLAN independent BPDU frames, such as GVRP or STP. However, they do affect VLAN dependent BPDU frames, such as GMRP.

- **Membership Type** – Select VLAN membership for each interface by marking the appropriate radio button for a port or trunk:

  - **Tagged**: Interface is a member of the VLAN. All packets transmitted by the port will be tagged, that is, carry a tag and therefore carry VLAN or CoS information.
  - **Untagged**: Interface is a member of the VLAN. All packets transmitted by the port will be untagged, that is, not carry a tag and therefore not carry VLAN or CoS information. Note that an interface must be assigned to at least one group as an untagged port.
  - **Forbidden**: Interface is forbidden from automatically joining the VLAN via GVRP. For more information, see “Automatic VLAN Registration” on page 3.
  - **None**: Interface is not a member of the VLAN. Packets associated with this VLAN will not be transmitted by the interface.

NOTE: VLAN 1 is the default untagged VLAN containing all ports on the switch using Access mode.

Edit Member by Interface

All parameters are the same as those described under the preceding section for Modify VLAN and Member Ports.

Edit Member by Interface Range

All parameters are the same as those described under the earlier section for Modify VLAN and Member Ports, except for the items shown below.

- **Port Range** – Displays a list of ports. (SSE-G2252/P: 1-52)
- **Trunk Range** – Displays a list of ports. (Range: 1-12)

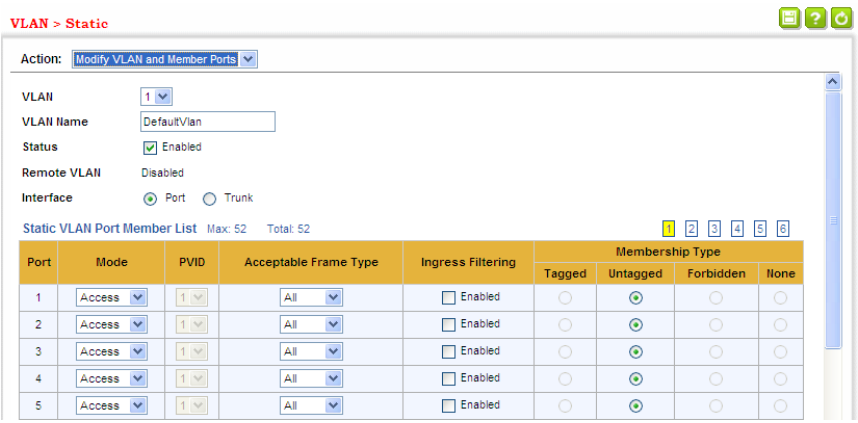
NOTE: The PVID, acceptable frame type, and ingress filtering parameters for each interface within the specified range must be configured on either the Modify VLAN and Member Ports or Edit Member by Interface page.

Web Interface

To configure static members by the VLAN index:

1. Click VLAN > STATIC.
2. Select MODIFY VLAN and MEMBER PORTS from the Action list.
3. Set the Interface type to display as PORT or TRUNK.
4. Modify the settings for any interface as required. Remember that MEMBERSHIP TYPE cannot be changed until an interface has been added to another VLAN and the PVID changed to anything other than **1**.
5. Click APPLY.

Figure 7-4. Configuring Static Members by VLAN Index

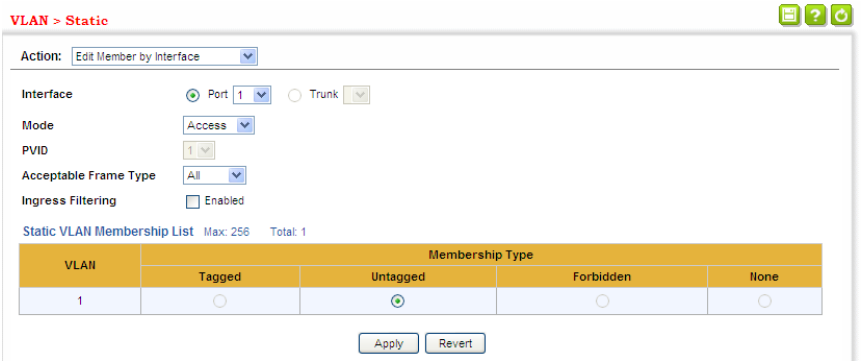

VLAN > Static
Action: Modify VLAN and Member Ports
VLAN 1
VLAN Name DefaultVlan
Status Enabled
Remote VLAN Disabled
Interface Port Trunk
Static VLAN Port Member List Max: 52 Total: 52
1 2 3 4 5 6
Port Mode PVID Acceptable Frame Type Ingress Filtering Membership Type
Tagged Untagged Forbidden None
1 Access 1 All Enabled
2 Access 1 All Enabled
3 Access 1 All Enabled
4 Access 1 All Enabled
5 Access 1 All Enabled

To configure static members by interface:

1. Click VLAN > STATIC.
2. Select EDIT MEMBER BY INTERFACE from the Action list.

3. Select a port or trunk configure.
4. Modify the settings for any interface as required.
5. Click APPLY.

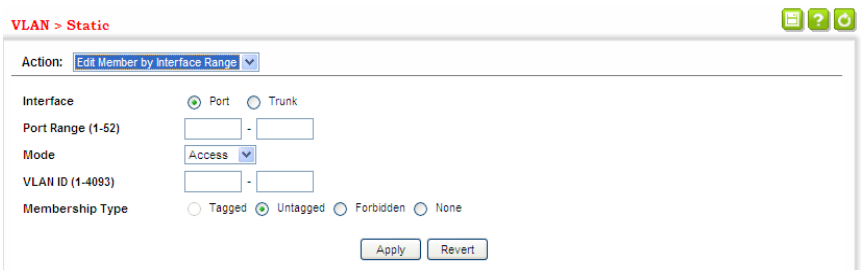
Figure 7-5. Configuring Static VLAN Members by Interface



To configure static members by interface range:

1. Click VLAN > STATIC.
2. Select EDIT MEMBER BY INTERFACE RANGE from the Action list.
3. Set the Interface type to display as PORT or TRUNK.
4. Enter an interface range.
5. Modify the VLAN parameters as required. Remember that the PVID, acceptable frame type, and ingress filtering parameters for each interface within the specified range must be configured on either the EDIT MEMBER BY VLAN or EDIT MEMBER BY INTERFACE page.
6. Click APPLY.

Figure 7-6. Configuring Static VLAN Members by Interface Range



Configuring Dynamic VLAN Registration

Use the VLAN > DYNAMIC page to enable GVRP globally on the switch, or to enable GVRP and adjust the protocol timers per interface.

CLI References

See Section 35-1: "GVRP and Bridge Extension Commands" on page 35-2 and Section 35-3: "Configuring VLAN Interfaces" on page 35-10 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Configure General

- **GVRP Status** – GVRP defines a way for switches to exchange VLAN information in order to register VLAN members on ports across the network. VLANs are dynamically configured based on join messages issued by host devices and propagated throughout the network. GVRP must be enabled to permit automatic VLAN registration, and to support VLANs which extend beyond the local switch. (Default: Disabled)

Configure Interface

- **Interface** – Displays a list of ports or trunks.
- **Port** – Port Identifier. (SSE-G2252/P: 1-52)
- **Trunk** – Trunk Identifier. (Range: 1-12)
- **GVRP Status** – Enables/disables GVRP for the interface. GVRP must be globally enabled for the switch before this setting can take effect (using the Configure General page). When disabled, any GVRP packets received on this port will be discarded and no GVRP registrations will be propagated from other ports. (Default: Disabled)

  GVRP cannot be enabled for ports set to Access mode (see "Adding Static Members to VLANs" on page 7-6).

- GVRP Timers – Timer settings must follow this rule:
  2 x (join timer) < leave timer < leaveAll timer

  - **Join** – The interval between transmitting requests/queries to participate in a VLAN group. (Range: 20-1000 centiseconds; Default: 20)
  - **Leave** – The interval a port waits before leaving a VLAN group. This time should be set to more than twice the join time. This ensures that after a Leave or LeaveAll message has been issued, the applicants can rejoin before the port actually leaves the group. (Range: 60-3000 centiseconds; Default: 60)

- **LeaveAll** – The interval between sending out a LeaveAll query message for VLAN group participants and the port leaving the group. This interval should be considerably larger than the Leave Time to minimize the amount of traffic generated by nodes rejoining the group. (Range: 500-18000 centiseconds; Default: 1000)

Show Dynamic VLAN – Show VLAN

- **VLAN ID** – Identifier of a VLAN this switch has joined through GVRP.
- **VLAN Name** – Name of a VLAN this switch has joined through GVRP.
- **Status** – Indicates if this VLAN is currently operational.
  (Display Values: Enabled, Disabled)

Show Dynamic VLAN – Show VLAN Member

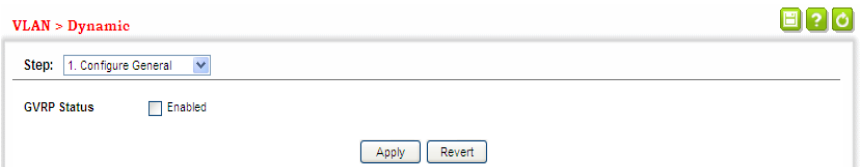
- **VLAN** – Identifier of a VLAN this switch has joined through GVRP.
- **Interface** – Displays a list of ports or trunks which have joined the selected VLAN through GVRP.

Web Interface

To configure GVRP on the switch:

1. Click VLAN > DYNAMIC.
2. Select CONFIGURE GENERAL from the Step list.
3. Enable or disable GVRP.
4. Click APPLY.

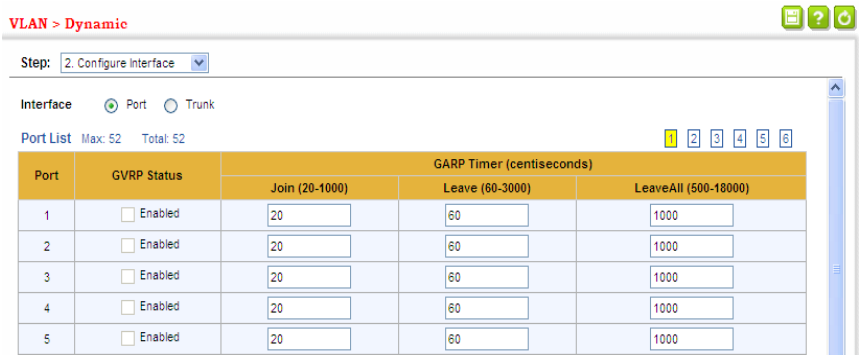
Figure 7-7. Configuring Global Status of GVRP



To configure GVRP status and timers on a port or trunk:

1. Click VLAN > DYNAMIC.
2. Select CONFIGURE INTERFACE from the Step list.
3. Set the Interface type to display as PORT or TRUNK.
4. Modify the GVRP status or timers for any interface.
5. Click APPLY.

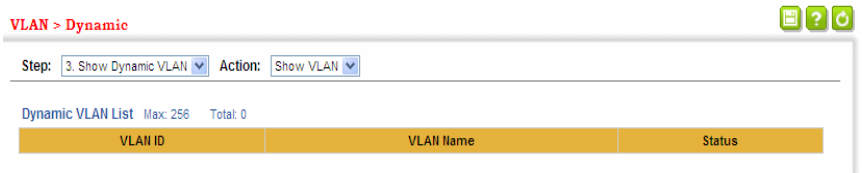
Figure 7-8. Configuring GVRP for an Interface



To show the dynamic VLAN joined by this switch:

1. Click VLAN > DYNAMIC.
2. Select SHOW DYNAMIC VLAN from the Step list.
3. Select SHOW VLAN from the Action list.

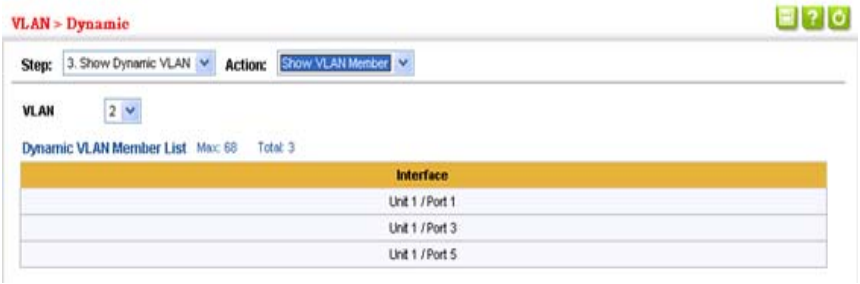
Figure 7-9. Showing Dynamic VLANs Registered on the Switch



To show the members of a dynamic VLAN:

1. Click VLAN > DYNAMIC.
2. Select SHOW DYNAMIC VLAN from the Step list.
3. Select SHOW VLAN MEMBERS from the Action list.

Figure 7-10. Showing the Members of a Dynamic VLAN


VLAN > Dynamic
Step: 3. Show Dynamic VLAN
Action: Show VLAN Member
VLAN 2
Dynamic VLAN Member List Max: 68 Total: 3
Interface
Unit 1 / Port 1
Unit 1 / Port 3
Unit 1 / Port 5

7-2 IEEE 802.1Q Tunneling

IEEE 802.1Q Tunneling (QinQ) is designed for service providers carrying traffic for multiple customers across their networks. QinQ tunneling is used to maintain customer-specific VLAN and Layer 2 protocol configurations even when different customers use the same internal VLAN IDs. This is accomplished by inserting Service Provider VLAN (SPVLAN) tags into the customer's frames when they enter the service provider's network, and then stripping the tags when the frames leave the network.

A service provider's customers may have specific requirements for their internal VLAN IDs and number of VLANs supported. VLAN ranges required by different customers in the same service-provider network might easily overlap, and traffic passing through the infrastructure might be mixed. Assigning a unique range of VLAN IDs to each customer would restrict customer configurations, require intensive processing of VLAN mapping tables, and could easily exceed the maximum VLAN limit of 4096.

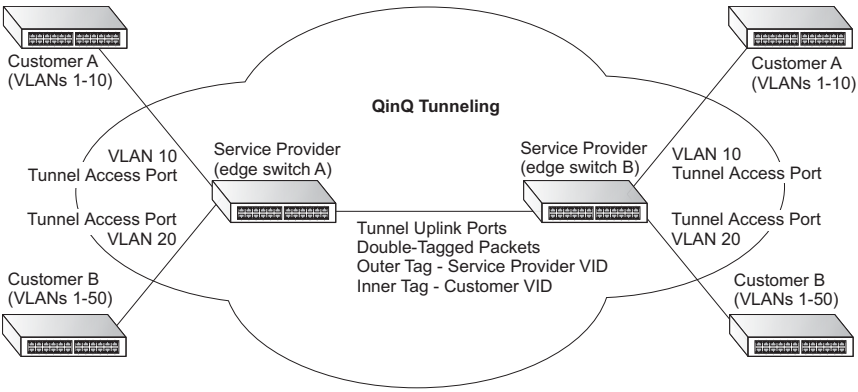
QinQ tunneling uses a single Service Provider VLAN (SPVLAN) for customers who have multiple VLANs. Customer VLAN IDs are preserved and traffic from different customers is segregated within the service provider's network even when they use the same customer-specific VLAN IDs. QinQ tunneling expands VLAN space by using a VLAN-in-VLAN hierarchy, preserving the customer's original tagged packets, and adding SPVLAN tags to each frame (also called double tagging).

A port configured to support QinQ tunneling must be set to tunnel port mode. The Service Provider VLAN (SPVLAN) ID for the specific customer must be assigned to the QinQ tunnel access port on the edge switch where the customer traffic enters the service provider's network. Each customer requires a separate SPVLAN, but this VLAN supports all of the customer's internal VLANs. The QinQ tunnel uplink port that passes traffic from the edge switch into the service provider's metro network must also be added to this SPVLAN. The uplink port can be added to multiple SPVLANs to carry inbound traffic for different customers onto the service provider's network.

When a double-tagged packet enters another trunk port in an intermediate or core switch in the service provider's network, the outer tag is stripped for packet processing. When the packet exits another trunk port on the same core switch, the same SPVLAN tag is again added to the packet.

When a packet enters the trunk port on the service provider's egress switch, the outer tag is again stripped for packet processing. However, the SPVLAN tag is not added when it is sent out the tunnel access port on the edge switch into the customer's network. The packet is sent as a normal IEEE 802.1Q-tagged frame, preserving the original VLAN numbers used in the customer's network.

Figure 7-11. QinQ Operational Concept



Layer 2 Flow for Packets Coming into a Tunnel Access Port

A QinQ tunnel port may receive either tagged or untagged packets. No matter how many tags the incoming packet has, it is treated as tagged packet.

The ingress process does source and destination lookups. If both lookups are successful, the ingress process writes the packet to memory. Then the egress process transmits the packet. Packets entering a QinQ tunnel port are processed in the following manner:

1. New SPVLAN tags are added to all incoming packets, no matter how many tags they already have. The ingress process constructs and inserts the outer tag (SPVLAN) into the packet based on the default VLAN ID and Tag Protocol Identifier (TPID, that is, the ether-type of the tag). This outer tag is used for learning and switching packets. The priority of the inner tag is copied to the outer tag if it is a tagged or priority tagged packet.
2. After successful source and destination lookup, the ingress process sends the packet to the switching process with two tags. If the incoming packet is untagged, the outer tag is an SPVLAN tag, and the inner tag is a dummy tag (8100 0000). If the incoming packet is tagged, the outer tag is an SPVLAN tag, and the inner tag is a CVLAN tag.

3. After packet classification through the switching process, the packet is written to memory with one tag (an outer tag) or with two tags (both an outer tag and inner tag).
4. The switch sends the packet to the proper egress port.
5. If the egress port is an untagged member of the SPVLAN, the outer tag will be stripped. If it is a tagged member, the outgoing packets will have two tags.

Layer 2 Flow for Packets Coming into a Tunnel Uplink Port

An uplink port receives one of the following packets:

- Untagged
- One tag (CVLAN or SPVLAN)
- Double tag (CVLAN + SPVLAN)

The ingress process does source and destination lookups. If both lookups are successful, the ingress process writes the packet to memory. Then the egress process transmits the packet. Packets entering a QinQ uplink port are processed in the following manner:

1. If incoming packets are untagged, the PVID VLAN native tag is added.
2. If the ether-type of an incoming packet (single or double tagged) is not equal to the TPID of the uplink port, the VLAN tag is determined to be a Customer VLAN (CVLAN) tag. The uplink port's PVID VLAN native tag is added to the packet. This outer tag is used for learning and switching packets within the service provider's network. The TPID must be configured on a per port basis, and the verification cannot be disabled.
3. If the ether-type of an incoming packet (single or double tagged) is equal to the TPID of the uplink port, no new VLAN tag is added. If the uplink port is not the member of the outer VLAN of the incoming packets, the packet will be dropped when ingress filtering is enabled. If ingress filtering is not enabled, the packet will still be forwarded. If the VLAN is not listed in the VLAN table, the packet will be dropped.
4. After successful source and destination lookups, the packet is double tagged. The switch uses the TPID of 0x8100 to indicate that an incoming packet is double-tagged. If the outer tag of an incoming double-tagged packet is equal to the port TPID and the inner tag is 0x8100, it is treated as a double-tagged packet. If a single-tagged packet has 0x8100 as its TPID, and port TPID is not 0x8100, a new VLAN tag is added and it is also treated as double-tagged packet.
5. If the destination address lookup fails, the packet is sent to all member ports of the outer tag's VLAN.
6. After packet classification, the packet is written to memory for processing as a single-tagged or double-tagged packet.
7. The switch sends the packet to the proper egress port.

8. If the egress port is an untagged member of the SPVLAN, the outer tag will be stripped. If it is a tagged member, the outgoing packet will have two tags.

Configuration Limitations for QinQ

- The native VLAN of uplink ports should not be used as the SPVLAN. If the SPVLAN is the uplink port's native VLAN, the uplink port must be an untagged member of the SPVLAN. Then the outer SPVLAN tag will be stripped when the packets are sent out. Another reason is that it causes non-customer packets to be forwarded to the SPVLAN.
- Static trunk port groups are compatible with QinQ tunnel ports as long as the QinQ configuration is consistent within a trunk port group.
- The native VLAN (VLAN 1) is not normally added to transmitted frames. Avoid using VLAN 1 as an SPVLAN tag for customer traffic to reduce the risk of misconfiguration. Instead, use VLAN 1 as a management VLAN instead of a data VLAN in the service provider network.
- There are some inherent incompatibilities between Layer 2 and Layer 3 switching:
- Tunnel ports do not support IP Access Control Lists.
- Layer 3 Quality of Service (QoS) and other QoS features containing Layer 3 information are not supported on tunnel ports.
- Spanning tree bridge protocol data unit (BPDU) filtering is automatically disabled on a tunnel port.

General Configuration Guidelines for QinQ

1. Enable TUNNEL STATUS, and set the Tag Protocol Identifier (TPID) value of the tunnel access port (in the ETHERNET TYPE field. This step is required if the attached client is using a nonstandard 2-byte ethertype to identify 802.1Q tagged frames. The default ethertype value is 0x8100. (See "Enabling QinQ Tunneling on the Switch" on page 7-17.)
2. Create a Service Provider VLAN, also referred to as an SPVLAN (see "Configuring VLAN Groups" on page 7-4).
3. Configure the QinQ tunnel access port to Access mode (see "Adding an Interface to a QinQ Tunnel" on page 7-18).
4. Configure the QinQ tunnel access port to join the SPVLAN as an untagged member (see "Adding Static Members to VLANs" on page 7-6).
5. Configure the SPVLAN ID as the native VID on the QinQ tunnel access port (see "Adding Static Members to VLANs" on page 7-6).
6. Configure the QinQ tunnel uplink port to Uplink mode (see "Adding an Interface to a QinQ Tunnel" on page 7-18).
7. Configure the QinQ tunnel uplink port to join the SPVLAN as a tagged member (see "Adding Static Members to VLANs" on page 7-6).

Enabling QinQ Tunneling on the Switch

Use the VLAN > TUNNEL (CONFIGURE GLOBAL) page to configure the switch to operate in IEEE 802.1Q (QinQ) tunneling mode, which is used for passing Layer 2 traffic across a service provider's metropolitan area network. You can also globally set the Tag Protocol Identifier (TPID) value of the tunnel port if the attached client is using a nonstandard 2-byte ethertype to identify 802.1Q tagged frames.

CLI References

See Section 35-5: "Configuring IEEE 802.1Q Tunneling" on page 35-20 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Tunnel Status** – Sets the switch to QinQ mode. (Default: Disabled)
- **Ethernet Type** – The Tag Protocol Identifier (TPID) specifies the ethertype of incoming packets on a tunnel port. (Range: hexadecimal 0800-FFFF; Default: 8100)

  Use this field to set a custom 802.1Q ethertype value. This feature allows the switch to interoperate with third-party switches that do not use the standard 0x8100 ethertype to identify 802.1Q-tagged frames. For example, if 0x1234 is set as the custom 802.1Q ethertype on a trunk port, incoming frames containing that ethertype are assigned to the VLAN contained in the tag following the ethertype field, as they would be with a standard 802.1Q trunk. Frames arriving on the port containing any other ethertype are looked upon as untagged frames, and assigned to the native VLAN of that port.

  All ports on the switch will be set to the same ethertype.

Web Interface

To enable QinQ Tunneling on the switch:

1. Click VLAN > TUNNEL.
2. Select CONFIGURE GLOBAL from the Step list.
3. Enable TUNNEL STATUS, and specify the TPID if a client attached to a tunnel port is using a non-standard ethertype to identify 802.1Q tagged frames.
4. Click APPLY.

Figure 7-12. Enabling QinQ Tunneling

Adding an Interface to a QinQ Tunnel

Follow the guidelines in the preceding section to set up a QinQ tunnel on the switch. Then use the VLAN > TUNNEL (CONFIGURE INTERFACE) page to set the tunnel mode for any participating interface.

CLI References

See Section 35-5: "Configuring IEEE 802.1Q Tunneling" on page 35-20 for CLI reference information.

Command Usage

- Use the CONFIGURE GLOBAL page to set the switch to QinQ mode before configuring a tunnel access port or tunnel uplink port (see "Enabling QinQ Tunneling on the Switch" on page 7-17). Also set the Tag Protocol Identifier (TPID) value of the tunnel access port if the attached client is using a nonstandard 2-byte ethertype to identify 802.1Q tagged frames.
- Then use the CONFIGURE INTERFACE page to set the access interface on the edge switch to Access mode, and set the uplink interface on the switch attached to the service provider network to Uplink mode.

Parameters

These parameters are displayed in the web interface:

- **Interface** – Displays a list of ports or trunks.
- **Port** – Port Identifier. (SSE-G2252/P: 1-52)
- **Trunk** – Trunk Identifier. (Range: 1-12)
- **Mode** – Sets the VLAN membership mode of the port.
- **None** – The port operates in its normal VLAN mode. (This is the default.)
  - **Access** – Configures QinQ tunneling for a client access port to segregate and preserve customer VLAN IDs for traffic crossing the service provider network.

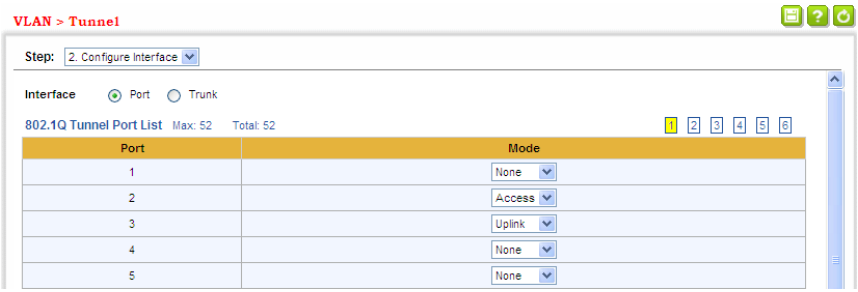
- **Uplink** – Configures QinQ tunneling for an uplink port to another device within the service provider network.

Web Interface

To add an interface to a QinQ tunnel:

1. Click VLAN > TUNNEL.
2. Select CONFIGURE INTERFACE from the Step list.
3. Set the mode for any tunnel access port to ACCESS and the tunnel uplink port to UPLINK.
4. Click APPLY.

Figure 7-13. Adding an Interface to a QinQ Tunnel



7-3 Protocol VLANs

The network devices required to support multiple protocols cannot be easily grouped into a common VLAN. This may require non-standard devices to pass traffic between different VLANs in order to encompass all the devices participating in a specific protocol. This kind of configuration deprives users of the basic benefits of VLANs, including security and easy accessibility.

To avoid these problems, you can configure this switch with protocol-based VLANs that divide the physical network into logical VLAN groups for each required protocol. When a frame is received at a port, its VLAN membership can then be determined based on the protocol type being used by the inbound packets.

Command Usage

To configure protocol-based VLANs, follow these steps:

1. First configure VLAN groups for the protocols you want to use (see "Editing VLAN Groups" on page 35-8). Although not mandatory, we suggest configuring a separate

VLAN for each major protocol running on your network. Do not add port members at this time.

2. Create a protocol group for each of the protocols you want to assign to a VLAN using the CONFIGURE PROTOCOL (ADD) page.
3. Then map the protocol for each interface to the appropriate VLAN using the CONFIGURE INTERFACE (ADD) page.

When MAC-based, IP subnet-based, and protocol-based VLANs are supported concurrently, priority is applied in this sequence, and then port-based VLANs last.

Configuring Protocol VLAN Groups

Use the VLAN > PROTOCOL (CONFIGURE PROTOCOL - ADD) page to create protocol groups.

CLI References

See "protocol-vlan protocol-group (Configuring Groups)" on page 35-27 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Frame Type** – Choose either Ethernet, RFC 1042, or LLC Other as the frame type used by this protocol.
- **Protocol Type** – Specifies the protocol type to match. The available options are IP, ARP, RARP and IPv6. If LLC Other is chosen for the Frame Type, the only available Protocol Type is IPX Raw.
- **Protocol Group ID** – Protocol Group ID assigned to the Protocol VLAN Group. (Range: 1-2147483647)

NOTE: Traffic which matches IP Protocol Ethernet Frames is mapped to the VLAN (VLAN 1) that has been configured with the switch's administrative IP. IP Protocol Ethernet traffic must not be mapped to another VLAN or you will lose administrative network connectivity to the switch. If lost in this manner, network access can be regained by removing the offending Protocol VLAN rule via the console. Alternately, the switch can be power-cycled, however all unsaved configuration changes will be lost.

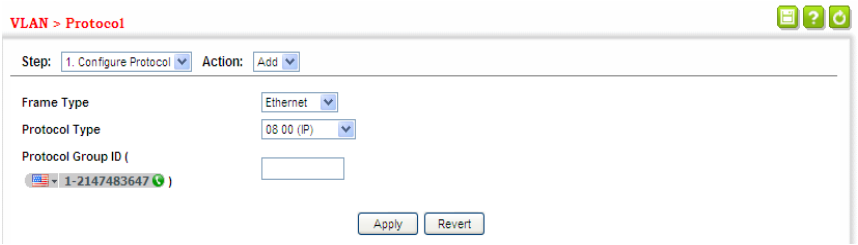
Web Interface

To configure a protocol group:

1. Click VLAN > PROTOCOL.
2. Select CONFIGURE PROTOCOL from the Step list.
3. Select ADD from the Action list.

4. Select an entry from the Frame Type list.
5. Select an entry from the Protocol Type list.
6. Enter an identifier for the protocol group.]
7. Click APPLY.

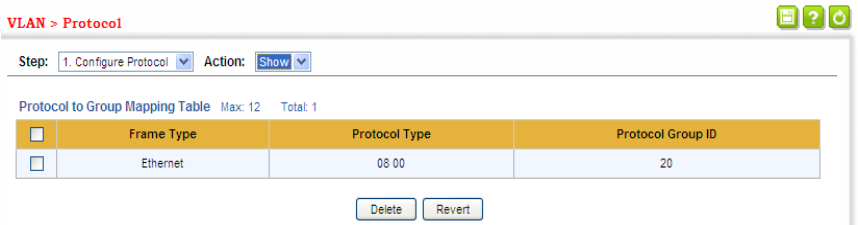
Figure 7-14. Configuring Protocol VLANs



To configure a protocol group:

1. Click VLAN > PROTOCOL.
2. Select CONFIGURE PROTOCOL from the Step list.
3. Select SHOW from the Action list.

Figure 7-15. Displaying Protocol VLANs



Mapping Protocol Groups to Interfaces

Use the VLAN > PROTOCOL (CONFIGURE INTERFACE - ADD) page to map a protocol group to a VLAN for each interface that will participate in the group.

CLI References

See "protocol-vlan protocol-group (Configuring Interfaces)" on page 35-28 for CLI reference information.

Command Usage

- When creating a protocol-based VLAN, only assign interfaces using this configuration screen. If you assign interfaces using any of the other VLAN menus such as the VLAN Static table (page 7-6), these interfaces will admit traffic of any protocol type into the associated VLAN.
- When a frame enters a port that has been assigned to a protocol VLAN, it is processed in the following manner:
  - If the frame is tagged, it will be processed according to the standard rules applied to tagged frames.
  - If the frame is untagged and the protocol type matches, the frame is forwarded to the appropriate VLAN.
  - If the frame is untagged but the protocol type does not match, the frame is forwarded to the default VLAN for this interface.

Parameters

These parameters are displayed in the web interface:

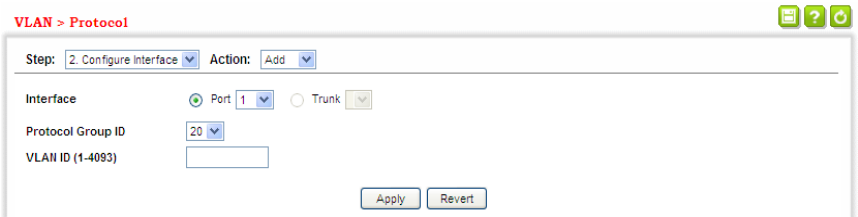
- **Interface** – Displays a list of ports or trunks.
- **Port** – Port Identifier. (SSE-G2252/P: 1-52)
- **Trunk** – Trunk Identifier. (Range: 1-12)
- **Protocol Group ID** – Protocol Group ID assigned to the Protocol VLAN Group. (Range: 1-2147483647)
- **VLAN ID** – VLAN to which matching protocol traffic is forwarded. (Range: 1-4093)

Web Interface

To map a protocol group to a VLAN for a port or trunk:

1. Click VLAN > PROTOCOL.
2. Select CONFIGURE INTERFACE from the Step list.
3. Select ADD from the Action list.
4. Select a port or trunk.
5. Enter the identifier for a protocol group.
6. Enter the corresponding VLAN to which the protocol traffic will be forwarded.
7. Click APPLY.

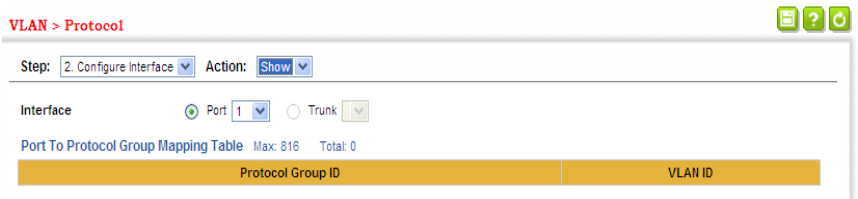
Figure 7-16. Assigning Interfaces to Protocol VLANs



To show the protocol groups mapped to a port or trunk:

1. Click VLAN > PROTOCOL.
2. Select CONFIGURE INTERFACE from the Step list.
3. Select SHOW from the Action list.

Figure 7-17. Showing the Interface to Protocol Group Mapping



7-4 Configuring IP Subnet VLANs

Use the VLAN > IP SUBNET page to configure IP subnet-based VLANs.

When using port-based classification, all untagged frames received by a port are classified as belonging to the VLAN whose VID (PVID) is associated with that port.

When IP subnet-based VLAN classification is enabled, the source address of untagged ingress frames are checked against the IP subnet-to-VLAN mapping table. If an entry is found for that subnet, these frames are assigned to the VLAN indicated in the entry. If no IP subnet is matched, the untagged frames are classified as belonging to the receiving port's VLAN ID (PVID).

CLI References

See Section 35-8: "Configuring IP Subnet VLANs" on page 35-31 for CLI reference information.

Command Usage

- Each IP subnet can be mapped to only one VLAN ID. An IP subnet consists of an IP address and a mask.
- When an untagged frame is received by a port, the source IP address is checked against the IP subnet-to-VLAN mapping table, and if an entry is found, the corresponding VLAN ID is assigned to the frame. If no mapping is found, the PVID of the receiving port is assigned to the frame.
- The IP subnet cannot be a broadcast or multicast IP address.
- When MAC-based, IP subnet-based, and protocol-based VLANs are supported concurrently, priority is applied in this sequence, and then port-based VLANs last.

Parameters

These parameters are displayed in the web interface:

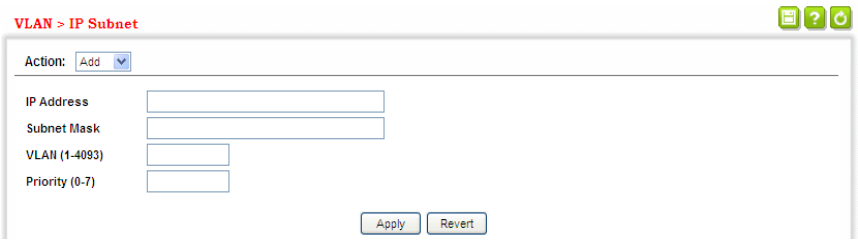
- **IP Address** – The IP address for a subnet. Valid IP addresses consist of four decimal numbers, 0 to 255, separated by periods.
- **Subnet Mask** – This mask identifies the host address bits of the IP subnet.
- **VLAN** – VLAN to which matching IP subnet traffic is forwarded.
  (Range: 1-4093)
- **Priority** – The priority assigned to untagged ingress traffic.
  (Range: 0-7, where 7 is the highest priority; Default: 0)

Web Interface

To map an IP subnet to a VLAN:

1. Click VLAN > IP SUBNET.
2. Select ADD from the Action list.
3. Enter an address in the IP ADDRESS field.
4. Enter a mask in the SUBNET MASK field.
5. Enter the identifier in the VLAN field. Note that the specified VLAN need not already be configured.
6. Enter a value to assign to untagged frames in the PRIORITY field.
7. Click APPLY.

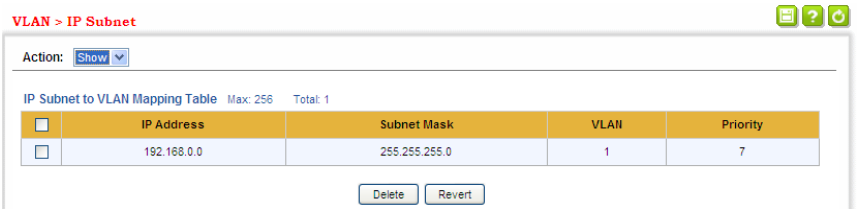
Figure 7-18. Configuring IP Subnet VLANs



To show the configured IP subnet VLANs:

1. Click VLAN > IP SUBNET.
2. Select SHOW from the Action list.

Figure 7-19. Showing IP Subnet VLANs



7-5 Configuring MAC-based VLANs

Use the VLAN > MAC-BASED page to configure VLAN based on MAC addresses. The MAC-based VLAN feature assigns VLAN IDs to ingress untagged frames according to source MAC addresses.

When MAC-based VLAN classification is enabled, untagged frames received by a port are assigned to the VLAN which is mapped to the frame's source MAC address. When no MAC address is matched, untagged frames are assigned to the receiving port's native VLAN ID (PVID).

CLI References

See Section 35-9: "Configuring MAC Based VLANs" on page 35-33 for CLI reference information.

Command Usage

- The MAC-to-VLAN mapping applies to all ports on the switch.
- Source MAC addresses can be mapped to only one VLAN ID.

- Configured MAC addresses cannot be broadcast or multicast addresses.
- When MAC-based, IP subnet-based, and protocol-based VLANs are supported concurrently, priority is applied in this sequence, and then port-based VLANs last.

Parameters

These parameters are displayed in the web interface:

- **MAC Address** – A source MAC address which is to be mapped to a specific VLAN. The MAC address must be specified in the format xx-xx-xx-xx-xx-xx.
- **VLAN** – VLAN to which ingress traffic matching the specified source MAC address is forwarded. (Range: 1-4093)
- **Priority** – The priority assigned to untagged ingress traffic. (Range: 0-7, where 7 is the highest priority; Default: 0)

Web Interface

To map a MAC address to a VLAN:

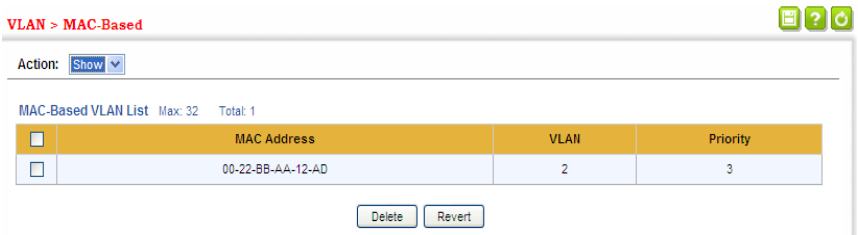
1. Click VLAN > MAC-BASED.
2. Select ADD from the Action list.
3. Enter an address in the MAC ADDRESS field.
4. Enter an identifier in the VLAN field. Note that the specified VLAN need not already be configured.
5. Enter a value to assign to untagged frames in the PRIORITY field.
6. Click APPLY.

Figure 7-20. Configuring MAC-Based VLANs

To show the MAC addresses mapped to a VLAN:

1. Click VLAN > MAC-BASED.
2. Select SHOW from the Action list.

Figure 7-21. Showing MAC-Based VLANs



7-6 Configuring VLAN Mirroring

Use the VLAN > MIRROR (ADD) page to mirror traffic from one or more source VLANs to a target port for real-time analysis. You can then attach a logic analyzer or RMON probe to the target port and study the traffic crossing the source VLAN(s) in a completely unobtrusive manner.

CLI References

See Chapter 30: "Port Mirroring Commands" on page 30-1 for CLI reference information.

Command Usage

- All active ports in a source VLAN are monitored for ingress traffic only.
- All VLAN mirror sessions must share the same target port, preferably one that is not a member of the source VLAN.
- When VLAN mirroring and port mirroring are both enabled, they must use the same target port.
- When VLAN mirroring and port mirroring are both enabled, the target port can receive a mirrored packet twice; once from the source mirror port and again from the source mirrored VLAN.
- The target port receives traffic from all monitored source VLANs and can become congested. Some mirror traffic may therefore be dropped from the target port.
- When mirroring VLAN traffic or packets based on a source MAC address (see Section 8-5: "Configuring MAC Address Mirroring" on page 8-6), the target port cannot be set to the same target ports as that used for port mirroring (see "Configuring Local Port Mirroring" on page 6-7).
- When traffic matches the rules for both port mirroring, and for mirroring of VLAN traffic or packets based on a MAC address, the matching packets will not be sent to target port specified for port mirroring.

Parameters

These parameters are displayed in the web interface:

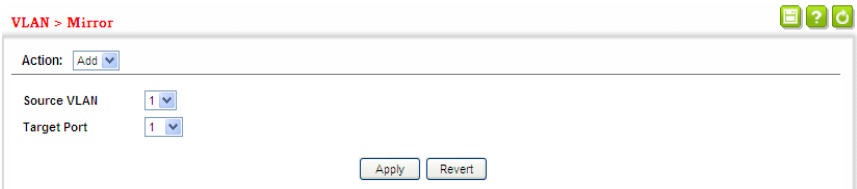
- **Source VLAN** – A VLAN whose traffic will be monitored.
  (Range: 1-4093)
- **Target Port** – The destination port that receives the mirrored traffic from the source VLAN. (SSE-G2252/P: 1-52)

Web Interface

To configure VLAN mirroring:

1. Click VLAN > MIRROR.
2. Select ADD from the Action list.
3. Select the source VLAN, and select a target port.
4. Click APPLY.

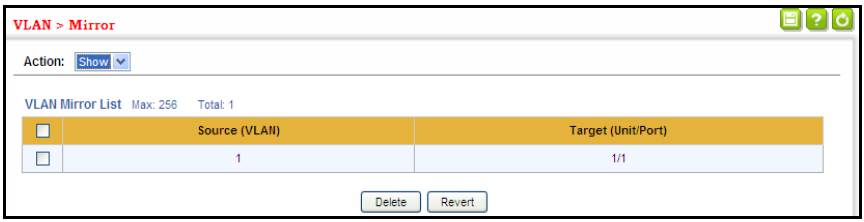
Figure 7-22. Configuring VLAN Mirroring



To show the VLANs to be mirrored:

1. Click VLAN > MIRROR.
2. Select SHOW from the Action list.

Figure 7-23. Showing the VLANs to Mirror



Chapter 8
Address Table Settings

Switches store the addresses for all known devices. This information is used to pass traffic directly between the inbound and outbound ports. All the addresses learned by monitoring traffic are stored in the dynamic address table. You can also manually configure static addresses that are bound to a specific port.

This chapter describes the following topics:

- "Setting Static Addresses" – Configures static entries in the address table.
- "Changing the Aging Time" – Sets time out for dynamically learned entries.
- "Displaying the Dynamic Address Table" – Shows how to display dynamic entries in the address table.
- "Clearing the Dynamic Address Table" – Shows how to clear dynamic entries in address table.
- "Configuring MAC Address Mirroring" – Mirrors traffic matching a specified source address to a target port.

8-1 Setting Static Addresses

Use the MAC ADDRESS > STATIC page to configure static MAC addresses. A static address can be assigned to a specific interface on this switch. Static addresses are bound to the assigned interface and will not be moved. When a static address is seen on another interface, the address will be ignored and will not be written to the address table.

CLI References

See "mac-address-table static" on page 33-2 for CLI reference information.

Command Usage

The static address for a host device can be assigned to a specific port within a specific VLAN. Use this command to add static addresses to the MAC Address Table. Static addresses have the following characteristics:

- Static addresses are bound to the assigned interface and will not be moved. When a static address is seen on another interface, the address will be ignored and will not be written to the address table.
- Static addresses will not be removed from the address table when a given interface link is down.
- A static address cannot be learned on another port until the address is removed from the table.

Parameters

These parameters are displayed in the web interface:

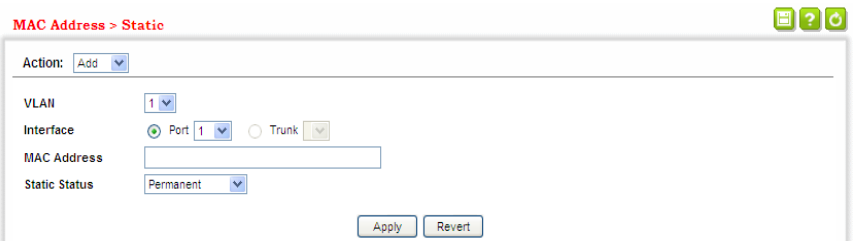
- **VLAN** – ID of configured VLAN. (Range: 1-4093)
- **Interface** – Port or trunk associated with the device assigned a static address.
- **MAC Address** – Physical address of a device mapped to this interface. Enter an address in the form of xx-xx-xx-xx-xx-xx or xxxxxxxxxxxx.
- **Static Status** – Sets the time to retain the specified address.
  - Delete-on-reset - Assignment lasts until the switch is reset.
  - Permanent - Assignment is permanent. (This is the default.)

WEB INTERFACE

To configure a static MAC address:

1. Click MAC ADDRESS > STATIC.
2. Select ADD from the Action list.
3. Specify the VLAN, the port or trunk to which the address will be assigned, the MAC address, and the time to retain this entry.
4. Click APPLY.

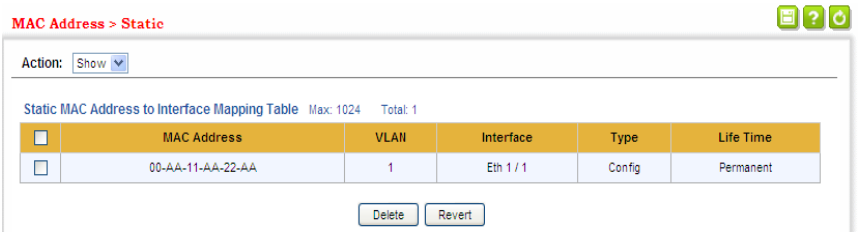
Figure 8-1. Configuring Static MAC Addresses



To show the static addresses in MAC address table:

1. Click MAC ADDRESS > STATIC.
2. Select SHOW from the Action list.

Figure 8-2. Displaying Static MAC Addresses



8-2 Changing the Aging Time

Use the MAC Address > Dynamic (Configure Aging) page to set the aging time for entries in the dynamic address table. The aging time is used to age out dynamically learned forwarding information.

CLI References

See "mac-address-table aging-time" on page 33-2 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

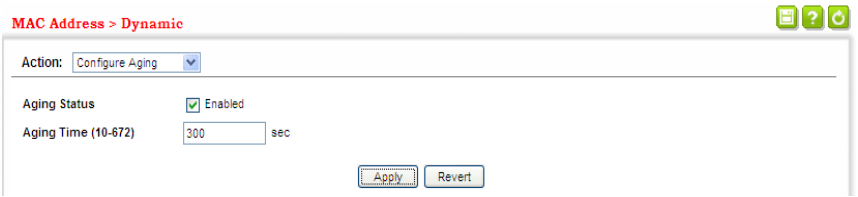
- **Aging Status** – Enables/disables the function.
- **Aging Time** – The time after which a learned entry is discarded. (SSE-G2252/P: 10-844 seconds; Default: 300 seconds)

Web Interface

To set the aging time for entries in the dynamic address table:

1. Click MAC Address, Dynamic.
2. Select Configure Aging from the Action list.
3. Modify the aging status if required.
4. Specify a new aging time.
5. Click Apply.

Figure 8-3. Setting the Address Aging Time



8-3 Displaying the Dynamic Address Table

Use the MAC ADDRESS > DYNAMIC (SHOW DYNAMIC MAC) page to display the MAC addresses learned by monitoring the source address for traffic entering the switch. When the destination address for inbound traffic is found in the database, the packets intended for that address are forwarded directly to the associated port. Otherwise, the traffic is flooded to all ports.

CLI References

See "show mac-address-table" on page 33-4 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

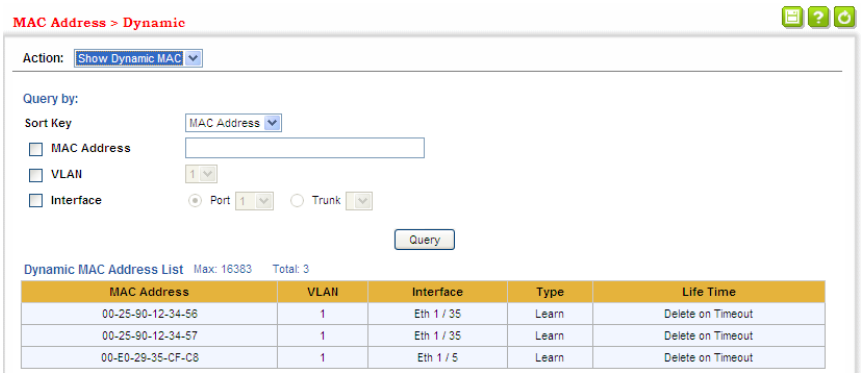
- **Sort Key** - You can sort the information displayed based on MAC address, VLAN or interface (port or trunk).
- **MAC Address** – Physical address associated with this interface.
- **VLAN** – ID of configured VLAN (1-4093).
- **Interface** – Indicates a port or trunk.
- **Type** – Shows that the entries in this table are learned.
- **Life Time** – Shows the time to retain the specified address.

Web Interface

To show the dynamic address table:

1. Click MAC ADDRESS > DYNAMIC.
2. Select SHOW DYNAMIC MAC from the Action list.
3. Select the SORT KEY (MAC ADDRESS, VLAN, or INTERFACE).
4. Enter the search parameters (MAC ADDRESS, VLAN, or INTERFACE).
5. Click QUERY.

Figure 8-4. Displaying the Dynamic MAC Address Table



8-4 Clearing the Dynamic Address Table

Use the MAC ADDRESS > DYNAMIC (CLEAR DYNAMIC MAC) page to remove any learned entries from the forwarding database.

CLI References

See "clear mac-address-table dynamic" on page 33-4 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

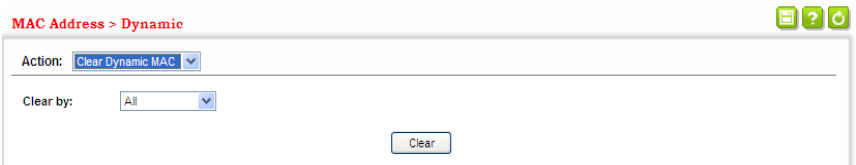
- **Clear by** – All entries can be cleared; or you can clear the entries for a specific MAC address, all the entries in a VLAN, or all the entries associated with a port or trunk.

Web Interface

To clear the entries in the dynamic address table:

1. Click MAC ADDRESS > DYNAMIC.
2. Select CLEAR DYNAMIC MAC from the Action list.
3. Select the method by which to clear the entries (i.e., ALL, MAC ADDRESS, VLAN, or INTERFACE).
4. Enter information in the additional fields required for clearing entries by MAC ADDRESS, VLAN, or INTERFACE.
5. Click CLEAR.

Figure 8-5. Clearing Entries in the Dynamic MAC Address Table



8-5 Configuring MAC Address Mirroring

Use the MAC ADDRESS > MIRROR (ADD) page to mirror traffic matching a specified source address from any port on the switch to a target port for real-time analysis. You can then attach a logic analyzer or RMON probe to the target port and study the traffic crossing the source port in a completely unobtrusive manner.

CLI References

See Section 30-1: "Local Port Mirroring Commands" on page 30-1 for CLI reference information.

Command Usage

- When mirroring traffic from a MAC address, ingress traffic with the specified source address entering any port in the switch, other than the target port, will be mirrored to the destination port.
- All mirror sessions must share the same destination port.
- Spanning Tree BPDU packets are not mirrored to the target port.
- When mirroring port traffic, the target port must be included in the same VLAN as the source port when using MSTP (see Chapter 9: "Spanning Tree Algorithm" on page 9-1).
- When mirroring VLAN traffic (see Section 7-6: "Configuring VLAN Mirroring" on page 7-27) or packets based on a source MAC address, the target port cannot be set to the same target ports as that used for port mirroring (see "Configuring Local Port Mirroring" on page 6-7).
- When traffic matches the rules for both port mirroring, and for mirroring of VLAN traffic or packets based on a MAC address, the matching packets will not be sent to target port specified for port mirroring.

Parameters

These parameters are displayed in the web interface:

- **Source MAC** – MAC address in the form of xx-xx-xx-xx-xx-xx or xxxxxxxxxxxx.

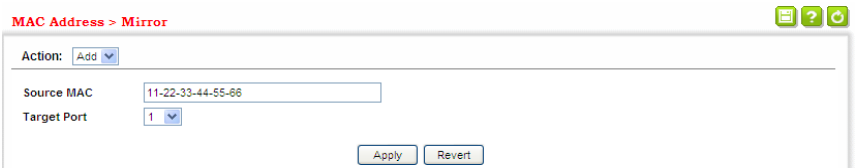
- **Target Port** – The port that will mirror the traffic from the source port. (SSE-G2252/P: 1-52)

Web Interface

To mirror packets based on a MAC address:

1. Click MAC ADDRESS > MIRROR
2. Select ADD from the Action list.
3. Specify the source MAC address and destination port.
4. Click APPLY.

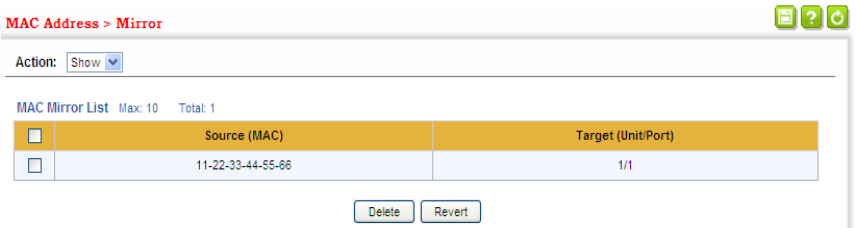
Figure 8-6. Mirroring Packets Based on the Source MAC Address



To show the MAC addresses to be mirrored:

1. Click MAC ADDRESS > MIRROR.
2. Select SHOW from the Action list.

Figure 8-7. Showing the Source MAC Addresses to Mirror



Chapter 9
Spanning Tree Algorithm

This chapter describes the following basic topics:

- Configuring Loopback Detection – Describes the configuration for detection and response to loopback BPDUs.
- Configuring Global Settings for STA – Describes the configuration for global bridge settings for STP, RSTP and MSTP.
- Configuring Interface Settings for STA – Describes the configuration for interface settings for STA, including priority, path cost, link type, and designation as an edge port.
- Displaying Interface Settings for STA Describes the configuration for displaying interface settings for STA.
- Configuring Multiple Spanning Trees – Describes the configuration for the VLANs and associated priority assigned to an MST instance.
- Configuring Interface Settings for MSTP – Describes the configuration for interface settings for MSTP, including priority and path cost.

9-1 Overview

The Spanning Tree Algorithm (STA) can be used to detect and disable network loops, and to provide backup links between switches, bridges or routers. This allows the switch to interact with other bridging devices (that is, an STA-compliant switch, bridge or router) in your network to ensure that only one route exists between any two stations on the network, and provide backup links which automatically take over when a primary link goes down.

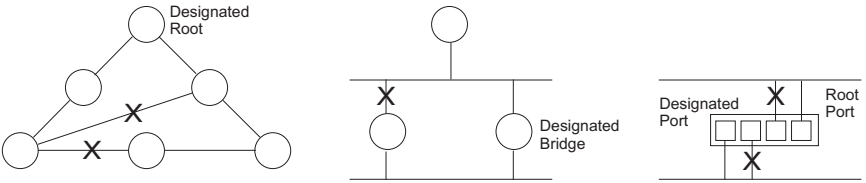
The spanning tree algorithms supported by this switch include these versions:

- **STP** – Spanning Tree Protocol (IEEE 802.1D)
- **RSTP** – Rapid Spanning Tree Protocol (IEEE 802.1w)
- **MSTP** – Multiple Spanning Tree Protocol (IEEE 802.1s)

STP

STP uses a distributed algorithm to select a bridging device (STP-compliant switch, bridge or router) that serves as the root of the spanning tree network. It selects a root port on each bridging device (except for the root device) which incurs the lowest path cost when forwarding a packet from that device to the root device. Then it selects a designated bridging device from each LAN which incurs the lowest path cost when forwarding a packet from that LAN to the root device. All ports connected to designated bridging devices are assigned as designated ports. After determining the lowest cost spanning tree, it enables all root ports and designated ports, and disables all other ports. Network packets are therefore only forwarded between root ports and designated ports, eliminating any possible network loops.

Figure 9-1. STP Root Ports and Designated Ports



Once a stable network topology has been established, all bridges listen for Hello BPDUs (Bridge Protocol Data Units) transmitted from the Root Bridge. If a bridge does not get a Hello BPDU after a predefined interval (Maximum Age), the bridge assumes that the link to the Root Bridge is down. This bridge will then initiate negotiations with other bridges to reconfigure the network to reestablish a valid network topology.

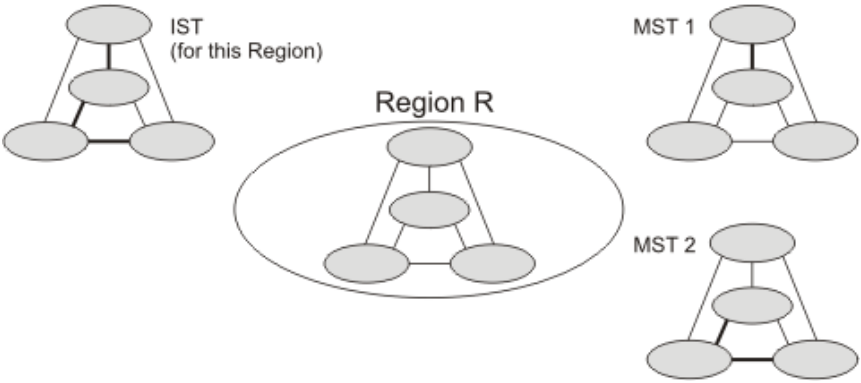
RSTP

RSTP is designed as a general replacement for the slower, legacy STP. RSTP is also incorporated into MSTP. RSTP achieves much faster reconfiguration (i.e., around 1 to 3 seconds, compared to 30 seconds or more for STP) by reducing the number of state changes before active ports start learning, predefining an alternate route that can be used when a node or port fails, and retaining the forwarding database for ports insensitive to changes in the tree structure when reconfiguration occurs.

MSTP

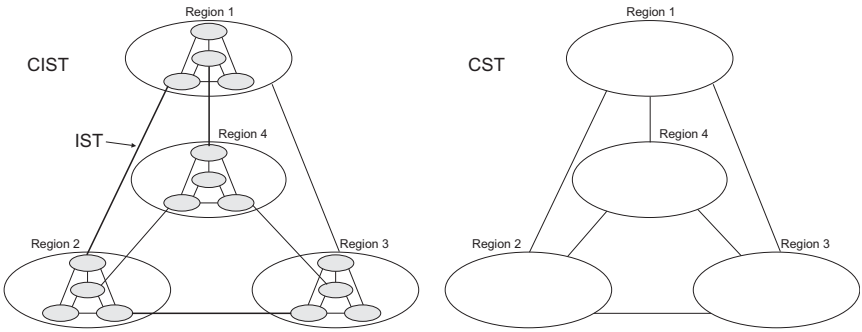
When using STP or RSTP, it may be difficult to maintain a stable path between all VLAN members. Frequent changes in the tree structure can easily isolate some of the group members. MSTP (which is based on RSTP for fast convergence) is designed to support independent spanning trees based on VLAN groups. Using multiple spanning trees can provide multiple forwarding paths and enable load balancing. One or more VLANs can be grouped into a Multiple Spanning Tree Instance (MSTI). MSTP builds a separate Multiple Spanning Tree (MST) for each instance to maintain connectivity among each of the assigned VLAN groups. MSTP then builds a Internal Spanning Tree (IST) for the Region containing all commonly configured MSTP bridges.

Figure 9-2. MSTP Region, Internal Spanning Tree, Multiple Spanning Tree



An MST Region consists of a group of interconnected bridges that have the An MST Region consists of a group of interconnected bridges that have the same MST Configuration Identifiers (including the Region Name, Revision Level and Configuration Digest – see Section 9-6: "Configuring Multiple Spanning Trees" on page 9-19). An MST Region may contain multiple MSTP Instances. An Internal Spanning Tree (IST) is used to connect all the MSTP switches within an MST region. A Common Spanning Tree (CST) interconnects all adjacent MST Regions, and acts as a virtual bridge node for communications with STP or RSTP nodes in the global network.

Figure 9-3. Common Internal Spanning Tree, Common Spanning Tree, Internal Spanning Tree



MSTP connects all bridges and LAN segments with a single Common and Internal Spanning Tree (CIST). The CIST is formed as a result of the running spanning tree algorithm between switches that support the STP, RSTP, MSTP protocols.

Once you specify the VLANs to include in a Multiple Spanning Tree Instance (MSTI), the protocol will automatically build an MSTI tree to maintain connectivity among each of the VLANs. MSTP maintains contact with the global network because each instance is treated as an RSTP node in the Common Spanning Tree (CST).

9-2 Configuring Loopback Detection

Use the SPANNING TREE > LOOPBACK DETECTION page to configure loopback detection on an interface. When loopback detection is enabled and a port or trunk receives it's own BPDU, the detection agent drops the loopback BPDU, sends an SNMP trap, and places the interface in discarding mode. This loopback state can be released manually or automatically. If the interface is configured for automatic loopback release, then the port will only be returned to the forwarding state if one of the following conditions is satisfied:

- The interface receives any other BPDU except for it's own, or;
- The interfaces's link status changes to link down and then link up again, or;
- The interface ceases to receive it's own BPDUs in a forward delay interval.

NOTE: If loopback detection is not enabled and an interface receives it's own BPDU, then the interface will drop the loopback BPDU according to IEEE Standard 802.1w-2001 9.3.4 (Note 1).

NOTE: Loopback detection will not be active if Spanning Tree is disabled on the switch.

NOTE: When configured for manual release mode, then a link down/up event will not release the port from the discarding state.

CLI References

See Section 35-2: "Editing VLAN Groups" on page 35-8 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Interface** – Displays a list of ports or trunks.
- **Status** – Enables loopback detection on this interface. (Default: Enabled)
- **Trap** – Enables SNMP trap notification for loopback events on this interface. (Default: Disabled)
- **Release Mode** – Configures the interface for automatic or manual loopback release. (Default: Auto)

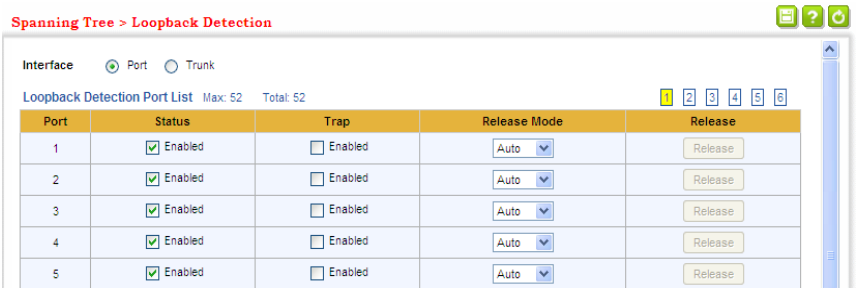
- **Release** – Allows an interface to be manually released from discard mode. This is only available if the interface is configured for manual release mode.

Web Interface

To configure loopback detection:

1. Click SPANNING TREE > LOOPBACK DETECTION.
2. Click PORT or TRUNK to display the required interface type.
3. Modify the required loopback detection attributes.
4. Click APPLY

Figure 9-4. Configuring Port Loopback Detection



9-3 Configuring Global Settings for STA

Use the SPANNING TREE > STA (CONFIGURE GLOBAL - CONFIGURE) page to configure global settings for the spanning tree that apply to the entire switch.

CLI References

See Chapter 34: "Spanning Tree Commands" on page 34-1 for CLI reference information.

Command Usage

- Spanning Tree Protocol[1]

1. STP and RSTP BPDUs are transmitted as untagged frames, and will cross any VLAN boundaries.

Uses RSTP for the internal state machine, but sends only 802.1D BPDUs. This creates one spanning tree instance for the entire network. If multiple VLANs are implemented on a network, the path between specific VLAN members may be inadvertently disabled to prevent network loops, thus isolating group members. When operating multiple VLANs, we recommend selecting the MSTP option.

- Rapid Spanning Tree Protocol[1]

  RSTP supports connections to either STP or RSTP nodes by monitoring the incoming protocol messages and dynamically adjusting the type of protocol messages the RSTP node transmits, as described below:

  - STP Mode – If the switch receives an 802.1D BPDU (i.e., STP BPDU) after a port's migration delay timer expires, the switch assumes it is connected to an 802.1D bridge and starts using only 802.1D BPDUs.
  - RSTP Mode – If RSTP is using 802.1D BPDUs on a port and receives an RSTP BPDU after the migration delay expires, RSTP restarts the migration delay timer and begins using RSTP BPDUs on that port.

- Multiple Spanning Tree Protocol

  MSTP generates a unique spanning tree for each instance. This provides multiple pathways across the network, thereby balancing the traffic load, preventing wide-scale disruption when a bridge node in a single instance fails, and allowing for faster convergence of a new topology for the failed instance.

  - To allow multiple spanning trees to operate over the network, you must configure a related set of bridges with the same MSTP configuration, allowing them to participate in a specific set of spanning tree instances.
  - A spanning tree instance can exist only on bridges that have compatible VLAN instance assignments.
  - Be careful when switching between spanning tree modes. Changing modes stops all spanning-tree instances for the previous mode and restarts the system in the new mode, temporarily disrupting user traffic.

Parameters

These parameters are displayed in the web interface:

Basic Configuration of Global Settings

- **Spanning Tree Status** – Enables/disables STA on this switch. (Default: Enabled)
- **Spanning Tree Type** – Specifies the type of spanning tree used on this switch:
  - **STP**: Spanning Tree Protocol (IEEE 802.1D); i.e., when this option is selected, the switch will use RSTP set to STP forced compatibility mode).
  - **RSTP**: Rapid Spanning Tree (IEEE 802.1w); RSTP is the default.
  - **MSTP**: Multiple Spanning Tree (IEEE 802.1s)

- **Priority** – Bridge priority is used in selecting the root device, root port, and designated port. The device with the highest priority becomes the STA root device. However, if all devices have the same priority, the device with the lowest MAC address will then become the root device. (Note that lower numeric values indicate higher priority.)
  - Default: 32768
  - Range: 0-61440, in steps of 4096
  - Options: 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, 61440

Advanced Configuration Settings

The following attributes are based on RSTP, but also apply to STP since the switch uses a backwards-compatible subset of RSTP to implement STP, and also apply to MSTP which is based on RSTP according to the standard:

- **Path Cost Method** – The path cost is used to determine the best path between devices. The path cost method is used to determine the range of values that can be assigned to each interface.
  - Long: Specifies 32-bit based values that range from 1-200,000,000. (This is the default.)
  - Short: Specifies 16-bit based values that range from 1-65535.
- **Transmission Limit** – The maximum transmission rate for BPDUs is specified by setting the minimum interval between the transmission of consecutive protocol messages. (Range: 1-10; Default: 3)

When the Switch Becomes Root

- **Hello Time** – Interval (in seconds) at which the root device transmits a configuration message.
  - Default: 2
  - Minimum: 1
  - Maximum: The lower of 10 or [(Max. Message Age / 2) -1]
- **Maximum Age** – The maximum time (in seconds) a device can wait without receiving a configuration message before attempting to reconfigure. All device ports (except for designated ports) should receive configuration messages at regular intervals. Any port that ages out STA information (provided in the last configuration message) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the device ports attached to the network. (References to “ports” in this section mean “interfaces,” which includes both ports and trunks.)
  - Default: 20
  - Minimum: The higher of 6 or [2 x (Hello Time + 1)]

- Maximum: The lower of 40 or [2 x (Forward Delay - 1)]

- **Forward Delay** – The maximum time (in seconds) this device will wait before changing states (i.e., discarding to learning to forwarding). This delay is required because every device must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to a discarding state; otherwise, temporary data loops might result.
  - Default: 15
  - Minimum: The higher of 4 or [(Max. Message Age / 2) + 1]
  - Maximum: 30

Configuration Settings for MSTP

- **Max Instance Numbers** – The maximum number of MSTP instances to which this switch can be assigned.
- **Configuration Digest** – An MD5 signature key that contains the VLAN ID to MST ID mapping table. In other words, this key is a mapping of all VLANs to the CIST.
- **Region Revision** [2] – The revision for this MSTI. (Range: 0-65535; Default: 0)
- **Region Name** [2] – The name for this MSTI. (Maximum length: 32 characters; switch's MAC address)
- **Max Hop Count** – The maximum number of hops allowed in the MST region before a BPDU is discarded. (Range: 1-40; Default: 20)

NOTE: Region Revision and Region Name and are both required to uniquely identify an MST region.

Web Interface

To configure global STA settings:

1. Click SPANNING TREE > STA.
2. Select CONFIGURE GLOBAL from the Step list.
3. Select CONFIGURE from the Action list.
4. Modify any of the required attributes. Note that the parameters displayed for the spanning tree types (STP, RSTP, MSTP) varies as described in the preceding section.
5. Click APPLY

2. The MST name and revision number are both required to uniquely identify an MST region.

Figure 9-5. Configuring Global Settings for STA (STP)

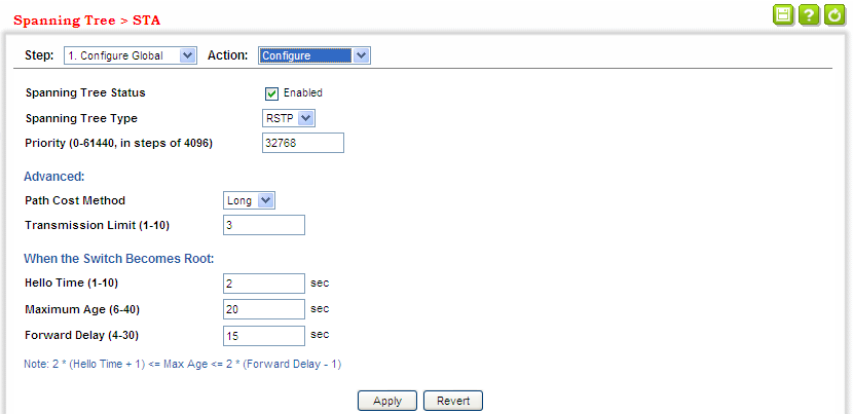


Figure 9-6. Configuring Global Settings for STA (RSTP)

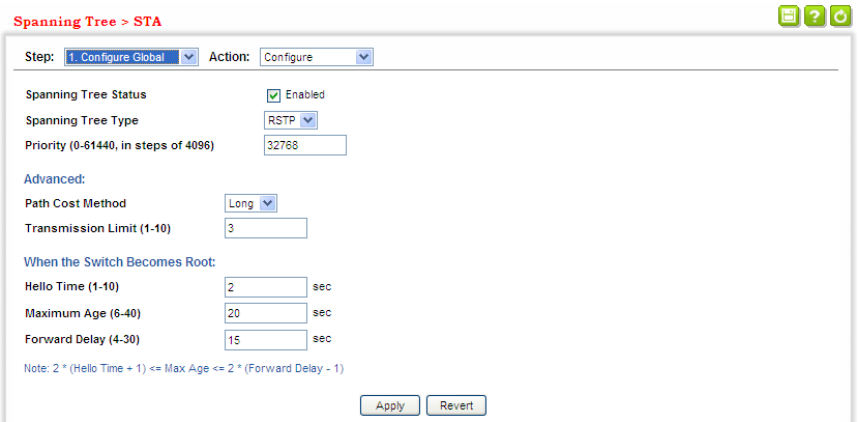
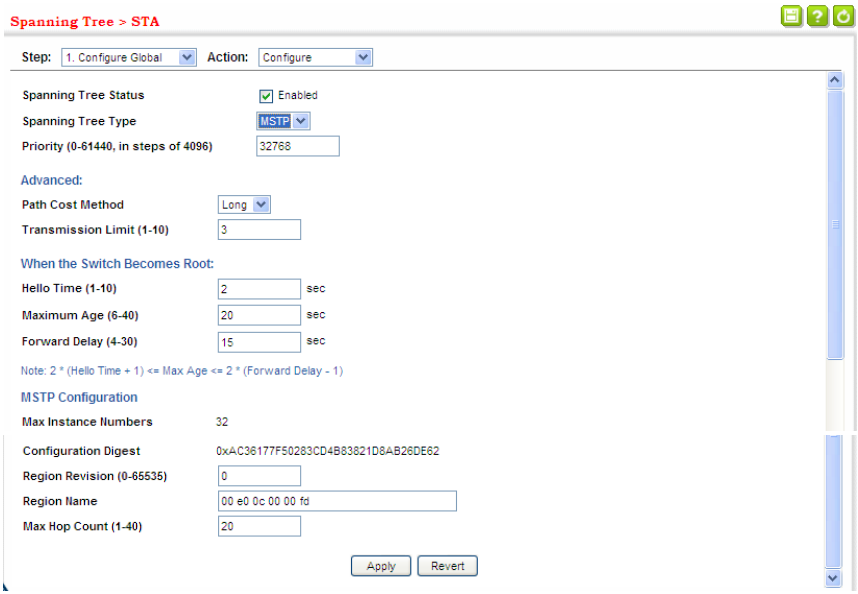


Figure 9-7. Configuring Global Settings for STA (MSTP)



Displaying Global Settings for STA

Use the SPANNING TREE > STA (CONFIGURE GLOBAL - SHOW INFORMATION) page to display a summary of the current bridge STA information that applies to the entire switch.

CLI References

See "show spanning-tree" on page 34-30 and "show spanning-tree mst configuration" on page 34-32 for CLI reference information.

Parameters

The parameters displayed in the web interface are described in the preceding section, except for the following items:

- **Bridge ID** – A unique identifier for this bridge, consisting of the bridge priority, the MST Instance ID 0 for the Common Spanning Tree when spanning tree type is set to MSTP, and MAC address (where the address is taken from the switch system).
- **Designated Root** – The priority and MAC address of the device in the Spanning Tree that this switch has accepted as the root device.

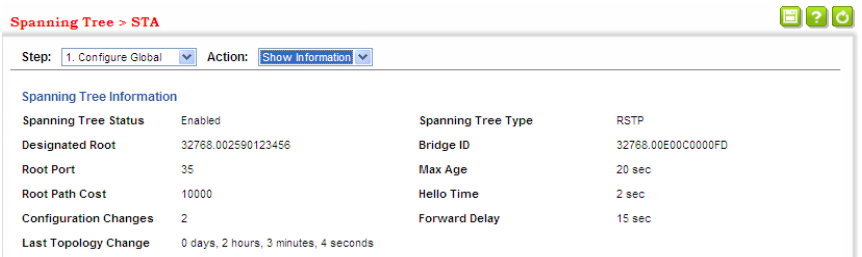
- **Root Port** – The number of the port on this switch that is closest to the root. This switch communicates with the root device through this port. If there is no root port, then this switch has been accepted as the root device of the Spanning Tree network.
- **Root Path Cost** – The path cost from the root port on this switch to the root device.
- **Configuration Changes** – The number of times the Spanning Tree has been reconfigured.
- **Last Topology Change** – Time since the Spanning Tree was last reconfigured.

Web Interface

To display global STA settings:

1. Click SPANNING TREE > STA.
2. Select CONFIGURE GLOBAL from the Step list.
3. Select SHOW INFORMATION from the Action list.

Figure 9-8. Displaying Global Settings for STA


Spanning Tree > STA
Step: 1. Configure Global
Action: Show Information
Spanning Tree Information
Spanning Tree Status Enabled
Spanning Tree Type RSTP
Designated Root 32768.002590123456
Bridge ID 32768.00E00C0000FD
Root Port 35
Max Age 20 sec
Root Path Cost 10000
Hello Time 2 sec
Configuration Changes 2
Forward Delay 15 sec
Last Topology Change 0 days, 2 hours, 3 minutes, 4 seconds

9-4 Configuring Interface Settings for STA

Use the SPANNING TREE > STA (CONFIGURE INTERFACE - CONFIGURE) page to configure RSTP and MSTP attributes for specific interfaces, including port priority, path cost, link type, and edge port. You may use a different priority or path cost for ports of the same media type to indicate the preferred path, link type to indicate a point-to-point connection or shared-media connection, and edge port to indicate if the attached device can support fast forwarding. (References to "ports" in this section means "interfaces," which includes both ports and trunks.)

CLI REFERENCES

See Chapter 34: "Spanning Tree Commands" on page 34-1 for CLI reference information.

PARAMETERS

These parameters are displayed in the web interface:

- **Interface** – Displays a list of ports or trunks.
- **Admin Edge Status for all ports** – Since end nodes **cannot** cause forwarding loops, they can pass directly through to the spanning tree forwarding state. Specifying Edge Ports provides quicker convergence for devices such as workstations or servers, retains the current forwarding database to reduce the amount of frame flooding required to rebuild address tables during reconfiguration events, does not cause the spanning tree to initiate reconfiguration when the interface changes state, and also overcomes other STA-related timeout problems. However, remember that Edge Port should only be enabled for ports connected to an end-node device. (Default: Enabled)
  - **Enabled** – Manually configures a port as an Edge Port.
  - **Disabled** – Disables the Edge Port setting.
  - **Auto** – The port will be automatically configured as an edge port if the edge delay time expires without receiving any RSTP or MSTP BPDUs. Note that edge delay time (802.1D-2004 17.20.4) equals the protocol migration time if a port's link type is point-to-point (which is 3 seconds as defined in IEEE 802.3D-2004 17.20.4); otherwise it equals the spanning tree's maximum age for configuration messages (see maximum age under Section 9-3: "Configuring Global Settings for STA" on page 9-5).

  An interface cannot function as an edge port under the following conditions:
  - If spanning tree mode is set to STP (page 9-5), edge-port mode cannot automatically transition to operational edge-port state using the automatic setting.
  - If loopback detection is enabled (page 9-4) and a loopback BPDU is detected, the interface cannot function as an edge port until the loopback state is released.
  - If an interface is in forwarding state and its role changes, the interface cannot continue to function as an edge port even if the edge delay time has expired.
  - If the port does not receive any BPDUs after the edge delay timer expires, its role changes to designated port and it immediately enters forwarding state (see Section 9-5: "Displaying Interface Settings for STA" on page 9-16).
- **Spanning Tree** – Enables/disables STA on this interface. (Default: Enabled)
- **Priority** – Defines the priority used for this port in the Spanning Tree Protocol. If the path cost for all ports on a switch are the same, the port with the highest priority (i.e., lowest value) will be configured as an active link in the Spanning Tree. This makes a port with higher priority less likely to be blocked if the Spanning Tree Protocol is detecting network loops. Where more than one port is assigned the highest priority, the port with lowest numeric identifier will be enabled.
  - Default: 128

- Range: 0-240, in steps of 16

- **Admin Path Cost** – This parameter is used by the STA to determine the best path between devices. Therefore, lower values should be assigned to ports attached to faster media, and higher values assigned to ports with slower media. Note that path cost takes precedence over port priority. (Range: 0 for auto-configuration, 1-65535 for the short path cost method[3], 1-200,000,000 for the long path cost method)

  By default, the system automatically detects the speed and duplex mode used on each port, and configures the path cost according to the values shown below. Path cost "0" is used to indicate auto-configuration mode. When the short path cost method is selected and the default path cost recommended by the IEEE 8021w standard exceeds 65,535, the default is set to 65,535.

Table 9-1. Recommended STA Path Cost Range

Port Type	IEEE 802.1D-1998	IEEE 802.1w-2001
Ethernet	50-600	200,000-20,000,000
Fast Ethernet	10-60	20,000-2,000,000
Gigabit Ethernet	3-10	2,000-200,000

Table 9-2. Default STA Path Costs

Port Type	Short Path Cost (IEEE 802.1D-1998)	Long Path Cost (802.1D-2004)
Ethernet	65,535	1,000,000
Fast Ethernet	65,535	100,000
Gigabit Ethernet	10,000	10,000

- **Admin Link Type** – The link type attached to this interface.
  - Point-to-Point – A connection to exactly one other bridge.
  - Shared – A connection to two or more bridges.
  - Auto – The switch automatically determines if the interface is attached to a point-to-point link or to shared media. (This is the default setting.)

- **Root Guard** – STA allows a bridge with a lower bridge identifier (or same identifier and lower MAC address) to take over as the root bridge at any time. Root Guard can be used to ensure that the root bridge is not formed at a suboptimal location. Root Guard should be enabled on any designated port connected to low-speed bridges which could potentially overload a slower link by taking over as the root port and forming a new spanning tree topology. It could also be used to form a border around part of the network where the root bridge is allowed. (Default: Disabled)

3. Refer to Section 9-3: "Configuring Global Settings for STA" on page 9-5 for information on setting the path cost method.

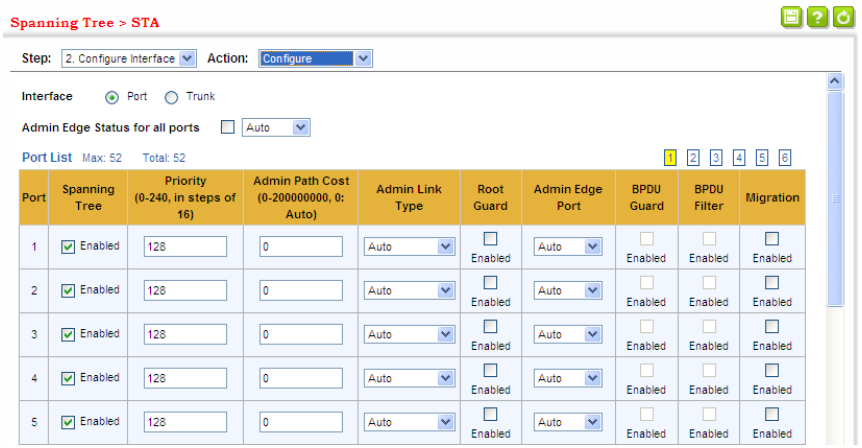
- **Admin Edge Port** – Refer to “Admin Edge Status for all ports” at the beginning of this section.
- **BPDU Guard** – This feature protects edge ports from receiving BPDUs. It prevents loops by shutting down an edge port when a BPDU is received instead of putting it into the spanning tree discarding state. In a valid configuration, configured edge ports should not receive BPDUs. If an edge port receives a BPDU an invalid configuration exists, such as a connection to an unauthorized device. The BPDU guard feature provides a secure response to invalid configurations because an administrator must manually enable the port. (Default: Disabled)
- **BPDU Filter** – BPDU filtering allows you to avoid transmitting BPDUs on configured edge ports that are connected to end nodes. By default, STA sends BPDUs to all ports regardless of whether administrative edge is enabled on a port. BDPU filtering is configured on a per-port basis. (Default: Disabled)
- **Migration** – If at any time the switch detects STP BPDUs, including Configuration or Topology Change Notification BPDUs, it will automatically set the selected interface to forced STP-compatible mode. However, you can also use the Protocol Migration button to manually re-check the appropriate BPDU format (RSTP or STP-compatible) to send on the selected interfaces. (Default: Disabled)

Web Interface

To configure interface settings for STA:

1. Click SPANNING TREE > STA.
2. Select CONFIGURE INTERFACE from the Step list.
3. Select CONFIGURE from the Action list.
4. Modify any of the required attributes.
5. Click APPLY.

Figure 9-9. Configuring Interface Settings for STA


Spanning Tree > STA
Step: 2. Configure Interface
Action: Configure
Interface
Port
Trunk
Admin Edge Status for all ports
Auto
Port List Max: 52 Total: 52
1 2 3 4 5 6
Port
Spanning Tree
Priority (0-240, in steps of 16)
Admin Path Cost (0-200000000, 0: Auto)
Admin Link Type
Root Guard
Admin Edge Port
BPDU Guard
BPDU Filter
Migration
1 Enabled 128 0 Auto Enabled Auto Enabled Enabled Enabled
2 Enabled 128 0 Auto Enabled Auto Enabled Enabled Enabled
3 Enabled 128 0 Auto Enabled Auto Enabled Enabled Enabled
4 Enabled 128 0 Auto Enabled Auto Enabled Enabled Enabled
5 Enabled 128 0 Auto Enabled Auto Enabled Enabled Enabled

9-5 Displaying Interface Settings for STA

Use the SPANNING TREE > STA (CONFIGURE INTERFACE - SHOW INFORMATION) page to display the current status of ports or trunks in the Spanning Tree.

CLI References

See "show spanning-tree" on page 34-30 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

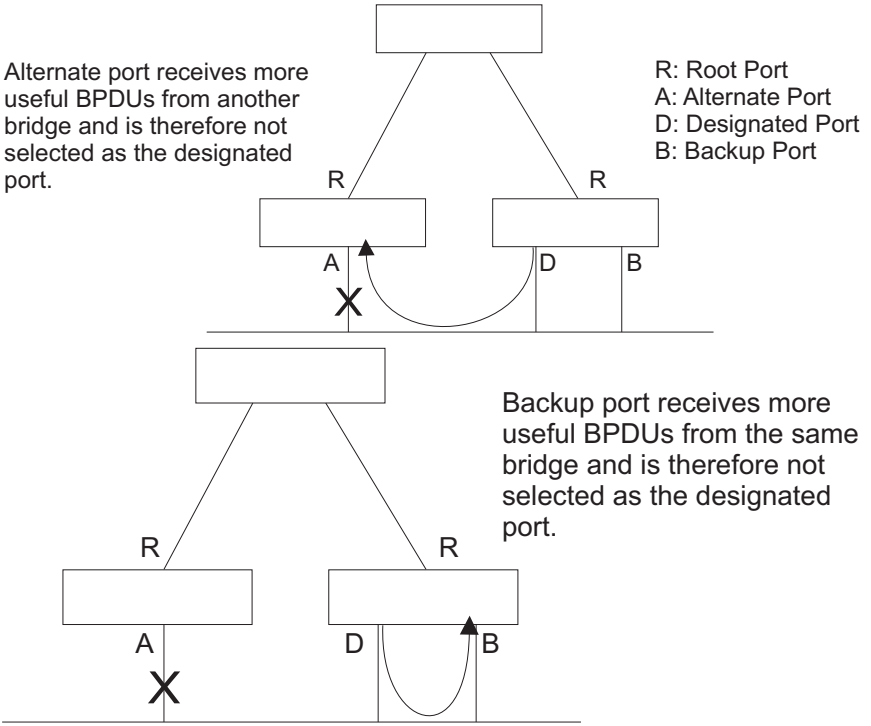
- **Spanning Tree** – Shows if STA has been enabled on this interface.
- **STA Status** – Displays current state of this port within the Spanning Tree:
  - **Discarding** - Port receives STA configuration messages, but does not forward packets.
  - **Learning** – Port has transmitted configuration messages for an interval set by the Forward Delay parameter without receiving contradictory information. Port address table is cleared, and the port begins learning addresses.
  - **Forwarding** – Port forwards packets, and continues learning addresses.

  The rules defining port status are:
  - A port on a network segment with no other STA compliant bridging device is always forwarding.

  - If two ports of a switch are connected to the same segment and there is no other STA device attached to this segment, the port with the smaller ID forwards packets and the other is discarding.
  - All ports are discarding when the switch is booted, then some of them change state to learning, and then to forwarding.

- **Forward Transitions** – The number of times this port has transitioned from the Learning state to the Forwarding state.
- **Designated Cost** – The cost for a packet to travel from this port to the root in the current Spanning Tree configuration. The slower the media, the higher the cost.
- **Designated Bridge** – The bridge priority and MAC address of the device through which this port must communicate to reach the root of the Spanning Tree.
- **Designated Port** – The port priority and number of the port on the designated bridging device through which this switch must communicate with the root of the Spanning Tree.
- **Oper Path Cost** – The contribution of this port to the path cost of paths towards the spanning tree root which include this port.
- **Oper Link Type** – The operational point-to-point status of the LAN segment attached to this interface. This parameter is determined by manual configuration or by auto-detection, as described for Admin Link Type in STA Port Configuration on page 9-12.
- **Oper Edge Port** – This parameter is initialized to the setting for Admin Edge Port in STA Port Configuration on page 9-12 (i.e., true or false), but will be set to false if a BPDU is received, indicating that another bridge is attached to this port.
- **Port Role** – Roles are assigned according to whether the port is part of the active topology connecting the bridge to the root bridge (i.e., **root** port), connecting a LAN through the bridge to the root bridge (i.e., **designated** port), is the MSTI regional root (i.e., **master** port), or is an **alternate** or **backup** port that may provide connectivity if other bridges, bridge ports, or LANs fail or are removed. The role is set to disabled (i.e., **disabled** port) if a port has no role within the spanning tree.

Figure 9-10. STA Port Roles

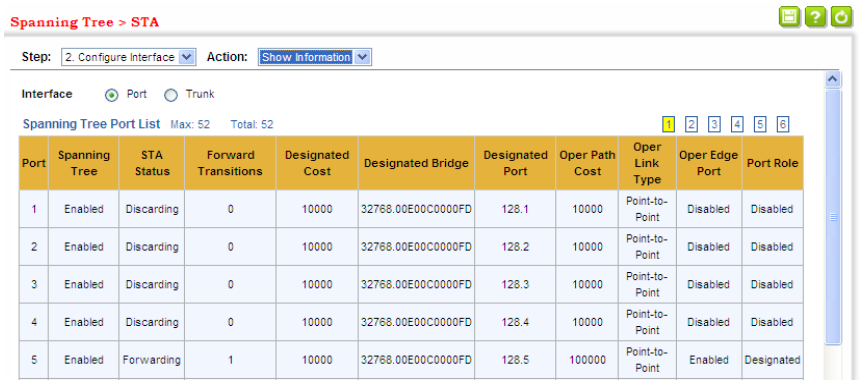


Web Interface

To display interface settings for STA:

1. Click SPANNING TREE > STA.
2. Select CONFIGURE INTERFACE from the Step list.
3. Select SHOW INFORMATION from the Action list.

Figure 9-11. Displaying Interface Settings for STA


Spanning Tree > STA
Step: 2. Configure Interface
Action: Show Information
Interface
Port
Trunk
Spanning Tree Port List Max: 52 Total: 52
1 2 3 4 5 6
Port
Spanning Tree
STA Status
Forward Transitions
Designated Cost
Designated Bridge
Designated Port
Oper Path Cost
Oper Link Type
Oper Edge Port
Port Role
1 Enabled Discarding 0 10000 32768.00E00C0000FD 128.1 10000 Point-to-Point Disabled Disabled
2 Enabled Discarding 0 10000 32768.00E00C0000FD 128.2 10000 Point-to-Point Disabled Disabled
3 Enabled Discarding 0 10000 32768.00E00C0000FD 128.3 10000 Point-to-Point Disabled Disabled
4 Enabled Discarding 0 10000 32768.00E00C0000FD 128.4 10000 Point-to-Point Disabled Disabled
5 Enabled Forwarding 1 10000 32768.00E00C0000FD 128.5 100000 Point-to-Point Enabled Designated

9-6 Configuring Multiple Spanning Trees

Use the SPANNING TREE > MSTP (CONFIGURE GLOBAL) page to create an MSTP instance, or to add VLAN groups to an MSTP instance.

CLI References

See Chapter 34: "Spanning Tree Commands" on page 34-1 for CLI reference information.

Command Usage

MSTP generates a unique spanning tree for each instance. This provides multiple pathways across the network, thereby balancing the traffic load, preventing wide-scale disruption when a bridge node in a single instance fails, and allowing for faster convergence of a new topology for the failed instance.

By default all VLANs are assigned to the Internal Spanning Tree (MST Instance 0) that connects all bridges and LANs within the MST region. This switch supports up to 33 instances. You should try to group VLANs which cover the same general area of your network. However, remember that you must configure all bridges within the same MSTI Region (page 9-5) with the same set of instances, and the same instance (on each bridge) with the same set of VLANs. Also, note that RSTP treats each MSTI region as a single node, connecting all regions to the Common Spanning Tree.

To use multiple spanning trees:

1. Set the spanning tree type to MSTP (page 9-5).
2. Enter the spanning tree priority for the selected MST instance on the Spanning Tree > MSTP (Configure Global - Add) page.

3. Add the VLANs that will share this MSTI on the Spanning Tree > MSTP (Configure Global - Add Member) page.

NOTE: All VLANs are automatically added to the IST (Instance 0).

To ensure that the MSTI maintains connectivity across the network, you must configure a related set of bridges with the same MSTI settings.

Parameters

These parameters are displayed in the web interface:

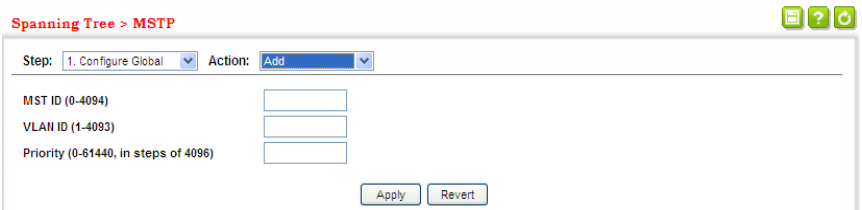
- **MST ID** – Instance identifier to configure. (Range: 0-4094)
- **VLAN ID** – VLAN to assign to this MST instance. (Range: 1-4093)
- **Priority** – The priority of a spanning tree instance. (Range: 0-61440 in steps of 4096; Options: 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, 61440; Default: 32768)

Web Interface

To create instances for MSTP:

1. Click SPANNING TREE > MSTP.
2. Select CONFIGURE GLOBAL from the Step list.
3. Select ADD from the Action list.
4. Specify the MST instance identifier and the initial VLAN member. Additional member can be added using the SPANNING TREE > MSTP (CONFIGURE GLOBAL - ADD MEMBER) page. If the priority is not specified, the default value 32768 is used.
5. Click APPLY.

Figure 9-12. Creating an MST Instance

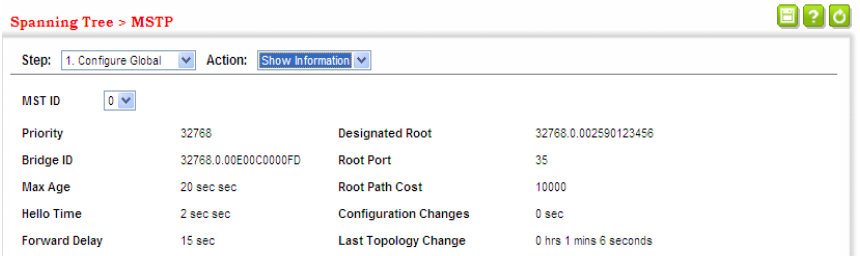


To show the MSTP instances:

1. Click SPANNING TREE > MSTP.
2. Select CONFIGURE GLOBAL from the Step list.

3. Select SHOW INFORMATION from the Action list.
4. Select an MST ID. The attributes displayed on this page are described under "Displaying Global Settings for STA" on page 9-11.

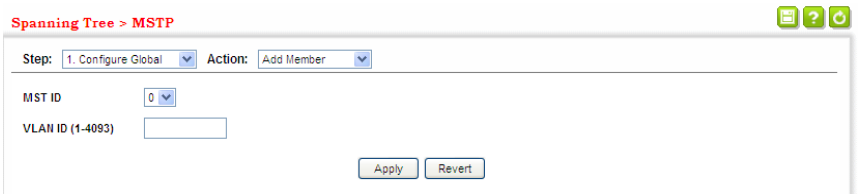
Figure 9-13. Displaying Global Settings for an MST Instance


Spanning Tree > MSTP
Step: 1. Configure Global
Action: Show Information
MST ID 0
Priority 32768
Designated Root 32768.0.002590123456
Bridge ID 32768.0.00E00C0000FD
Root Port 35
Max Age 20 sec sec
Root Path Cost 10000
Hello Time 2 sec sec
Configuration Changes 0 sec
Forward Delay 15 sec
Last Topology Change 0 hrs 1 mins 6 seconds

To add additional VLAN groups to an MSTP instance:

1. Click SPANNING TREE > MSTP.
2. Select CONFIGURE GLOBAL from the Step list.
3. Select ADD MEMBER from the Action list.
4. Select an MST instance from the MST ID list.
5. Enter the VLAN group to add to the instance in the VLAN ID field. Note that the specified member does not have to be a configured VLAN.
6. Click APPLY.

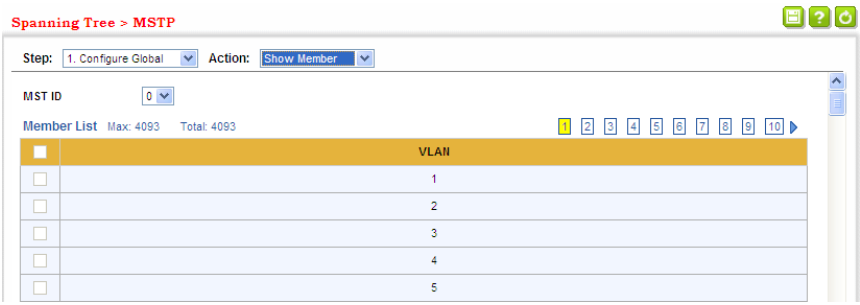
Figure 9-14. Adding a VLAN to an MST Instance



To show the VLAN member of an MSTP instance:

1. Click SPANNING TREE > MSTP.
2. Select CONFIGURE GLOBAL from the Step list.
3. Select SHOW MEMBER from the Action list.

Figure 9-15. Displaying Members of an MST Instance



9-7 Configuring Interface Settings for MSTP

Use the SPANNING TREE > MSTP (CONFIGURE INTERFACE - CONFIGURE) page to configure the STA interface settings for an MST instance.

CLI References

See Chapter 34: "Spanning Tree Commands" on page 34-1 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **MST ID** – Instance identifier to configure. (Default: 0)
- **Interface** – Displays a list of ports or trunks.
- **STA Status** – Displays the current state of this interface within the Spanning Tree. (See Section 9-5: "Displaying Interface Settings for STA" on page 9-16 for additional information.)
  - **Discarding** – Port receives STA configuration messages, but does not forward packets.
  - **Learning** – Port has transmitted configuration messages for an interval set by the Forward Delay parameter without receiving contradictory information. Port address table is cleared, and the port begins learning addresses.
  - **Forwarding** – Port forwards packets, and continues learning addresses.

- **Priority** – Defines the priority used for this port in the Spanning Tree Protocol. If the path cost for all ports on a switch are the same, the port with the highest priority (i.e., lowest value) will be configured as an active link in the Spanning Tree. This makes a port with higher priority less likely to be blocked if the Spanning Tree Protocol is detecting network loops. Where more than one port is assigned the highest priority, the port with lowest numeric identifier will be enabled. (Default: 128; Range: 0-240, in steps of 16)
- **Admin MST Path Cost** – This parameter is used by the MSTP to determine the best path between devices. Therefore, lower values should be assigned to ports attached to faster media, and higher values assigned to ports with slower media. (Path cost takes precedence over port priority.) Note that when the Path Cost Method is set to short (page 3-63), the maximum path cost is 65,535.

  By default, the system automatically detects the speed and duplex mode used on each port, and configures the path cost according to the values shown below. Path cost "0" is used to indicate auto-configuration mode. When the short path cost method is selected and the default path cost recommended by the IEEE 8021w standard exceeds 65,535, the default is set to 65,535

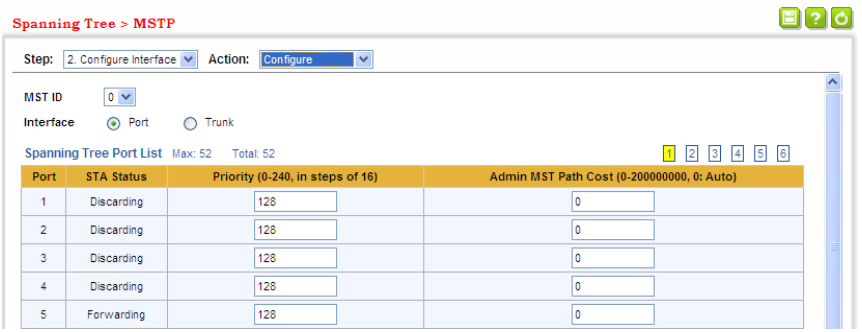
  The recommended range is listed in Table 9-1: "Recommended STA Path Cost Range" on page 9-14. The default path costs are listed in Table 9-2: "Default STA Path Costs" on page 9-14.

Web Interface

To configure MSTP parameters for a port or trunk:

1. Click SPANNING TREE > MSTP.
2. Select CONFIGURE INTERFACE from the Step list.
3. Select CONFIGURE from the Action list.
4. Enter the priority and path cost for an interface
5. Click APPLY.

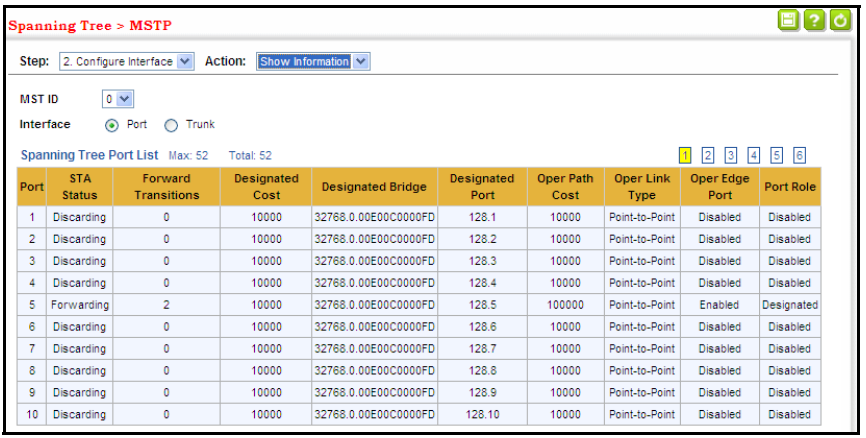
Figure 9-16. Configuring MSTP Interface Settings


Spanning Tree > MSTP
Step: 2. Configure Interface
Action: Configure
MST ID 0
Interface Port Trunk
Spanning Tree Port List Max: 52 Total: 52
1 2 3 4 5 6
Port
STA Status
Priority (0-240, in steps of 16)
Admin MST Path Cost (0-200000000, 0: Auto)
1 Discarding 128 0
2 Discarding 128 0
3 Discarding 128 0
4 Discarding 128 0
5 Forwarding 128 0

To display MSTP parameters for a port or trunk:

1. Click SPANNING TREE > MSTP.
2. Select CONFIGURE INTERFACE from the Step list.
3. Select SHOW INFORMATION from the Action list.

Figure 9-17. Displaying MSTP Interface Settings



Spanning Tree > MSTP

Step: 2. Configure Interface Action: Show Information

MST ID 0

Interface Port Trunk

Spanning Tree Port List Max: 52 Total: 52 1 2 3 4 5 6

Port	STA Status	Forward Transitions	Designated Cost	Designated Bridge	Designated Port	Oper Path Cost	Oper Link Type	Oper Edge Port	Port Role
1	Discarding	0	10000	32768.0.00E00C0000FD	128.1	10000	Point-to-Point	Disabled	Disabled
2	Discarding	0	10000	32768.0.00E00C0000FD	128.2	10000	Point-to-Point	Disabled	Disabled
3	Discarding	0	10000	32768.0.00E00C0000FD	128.3	10000	Point-to-Point	Disabled	Disabled
4	Discarding	0	10000	32768.0.00E00C0000FD	128.4	10000	Point-to-Point	Disabled	Disabled
5	Forwarding	2	10000	32768.0.00E00C0000FD	128.5	100000	Point-to-Point	Enabled	Designated
6	Discarding	0	10000	32768.0.00E00C0000FD	128.6	10000	Point-to-Point	Disabled	Disabled
7	Discarding	0	10000	32768.0.00E00C0000FD	128.7	10000	Point-to-Point	Disabled	Disabled
8	Discarding	0	10000	32768.0.00E00C0000FD	128.8	10000	Point-to-Point	Disabled	Disabled
9	Discarding	0	10000	32768.0.00E00C0000FD	128.9	10000	Point-to-Point	Disabled	Disabled
10	Discarding	0	10000	32768.0.00E00C0000FD	128.10	10000	Point-to-Point	Disabled	Disabled

Chapter 10
Congestion Control

The switch can set the maximum upload or download data transfer rate for any port. It can control traffic storms by setting a maximum threshold for broadcast traffic or multicast traffic. It can also set bounding thresholds for broadcast and multicast storms which can be used to automatically trigger rate limits or to shut down a port.

Congestion Control includes following options:

- "Rate Limiting" – Sets the input and output rate limits for a port.
- "Storm Control" – Sets the traffic storm threshold for each interface.
- "Automatic Traffic Control"– Sets thresholds for broadcast and multicast storms which can be used to trigger configured rate limits or to shut down a port.

10-1 Rate Limiting

Use the TRAFFIC > CONGESTION CONTROL > RATE LIMIT page to apply rate limiting to ingress or egress ports. This function allows the network manager to control the maximum rate for traffic received or transmitted on an interface. Rate limiting is configured on interfaces at the edge of a network to limit traffic into or out of the network. Packets that exceed the acceptable amount of traffic are dropped.

Rate limiting can be applied to individual ports. When an interface is configured with this feature, the traffic rate will be monitored by the hardware to verify conformity. Non-conforming traffic is dropped, conforming traffic is forwarded without any changes.

CLI References

See Chapter 31: "Rate Limit Commands" on page 31-1 for CLI reference information.

Command Usage

The ASIC used to control the ingress rate limit has a default time frame of 1 ms, 10 ms, 100 ms, and 1 second respectively for 10 Gbps, 1 Gbps, 100 Mbps, and 10 Mbps connection rates. Ingress rate limiting is processed 100 times per second (also referred to as 100 scales per second), regardless of the packet size.

NOTE: Egress rate limiting does not function in this manner.

For example, a Gigabit port has a 10 ms window size, so there are 100 scales per second, each scale having a bandwidth of 10 Mbps, and using an inter-packet gap of 20 bytes.

Therefore, when the rate limit is set at 64 kbit/s, each scale has a shared bandwidth of 80 bytes.

When the packet size = 64 bytes, and the gap = 20 bytes,
each packet = 84 bytes > 80bytes. Only one packet can pass through in each scale. One second has 100 scales, so the rate is 100 packets per second.

When the packet size = 640 bytes, and the gap = 20 bytes,
each packet = 660 bytes > 80 bytes. The switch will only let one packet pass in each scale, so there are still 100 packets per second.

When the packet size = 1500 bytes, and the gap = 20 bytes,
each packet = 1520 bytes > 80 bytes. The switch will only let one packet pass in each scale, so there are still 100 packets per second.

The following table shows the actual number of packets received when various ingress rate limits are applied to packets of different sizes. The values shown below were measured for both ingress rate limiting and storm control functions.

Table 10-1. Effective Rate Limit

Packet Size	Rate Limit	Packets Received
64 bytes	64 kbit/s	100
	128 kbit/s	200
	256 kbit/s	400
	512 kbit/s	800
	1024 kbit/s	1600
	2048 kbit/s	3105
128 bytes	64 kbit/s	100
	128 kbit/s	100
	256 kbit/s	300
	512 kbit/s	500
	1024 kbit/s	900
	2048 kbit/s	1800
512 bytes	64 kbit/s	100
	128 kbit/s	100
	256 kbit/s	100
	512 kbit/s	200
	1024 kbit/s	300
	2048 kbit/s	500

NOTE: Due to a chip limitation, the switch supports only one limit for both ingress rate limiting and storm control (including broadcast unknown unicast, multicast, and broadcast storms).

Parameters

These parameters are displayed in the web interface:

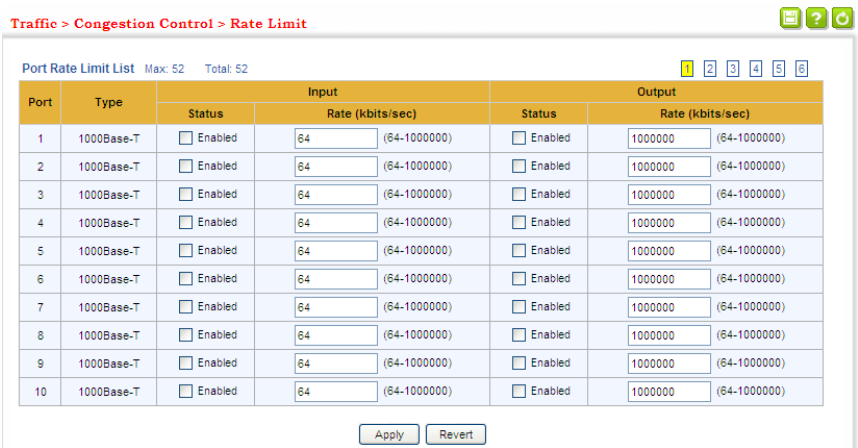
- **Port** – Displays the port number.
- **Type** – Indicates the port type. (100Base-TX, 1000Base-T, or SFP)
- **Status** – Enables or disables the rate limit. (Default: Disabled)
- **Rate** – Sets the rate limit level. (Range: 64 - 100,000 kbits per second for Fast Ethernet ports; 64 - 1,000,000 kbits per second for Gigabit Ethernet ports)

Web Interface

To configure rate limits:

1. Click TRAFFIC > CONGESTION CONTROL > RATE LIMIT.
2. Enable the RATE LIMIT STATUS for the required ports.
3. Set the rate limit for the individual ports.
4. Click APPLY.

Figure 10-1. Configuring Rate Limits



10-2 Storm Control

Use the TRAFFIC > CONGESTION CONTROL > STORM CONTROL page to configure broadcast, multicast, and unknown unicast storm control thresholds. Traffic storms may occur when a device on your network is malfunctioning, or if application programs are not well designed or properly configured. If there is too much traffic on your network, performance can be severely degraded or everything can come to complete halt.

You can protect your network from traffic storms by setting a threshold for broadcast, multicast or unknown unicast traffic. Any packets exceeding the specified threshold will then be dropped.

CLI References

See "switchport packet-rate" on page 27-12 for CLI reference information.

Command Usage

- Storm Control is disabled by default.
- Broadcast control does not effect IP multicast traffic.
- When traffic exceeds the threshold specified for broadcast and multicast or unknown unicast traffic, packets exceeding the threshold are dropped until the rate falls back down beneath the threshold.
- Storm control is a hardware level function. Traffic storms can also be controlled at the software level using automatic storm control which triggers various control responses (see Section 10-3: "Automatic Traffic Control" on page 10-6). However, only one of these control types can be applied to a port. Enabling hardware-level storm control on a port will disable automatic storm control on that port.
- Rate limits set by the storm control function are also used by automatic storm control when the control response is set to rate limiting.
- Using both rate limiting and storm control on the same interface may lead to unexpected results. For example, suppose broadcast storm control is set to 500 Kbps by the command "switchport broadcast packet-rate 500," and the rate limit is set to 20000 Kbps by the command "rate-limit input 20000" on a Fast Ethernet port. Since 20000 Kbps is 1/5 of line speed (100 Mbps), the received rate will actually be 100 Kbps, or 1/5 of the 500 Kbps limit set by the storm control command. It is therefore not advisable to use both of these commands on the same interface.
- The description of effective rate limiting (see Command Usage under Section 10-1: "Rate Limiting" on page 10-1) also applies to storm control.

NOTE: Due to a chip limitation, the switch supports only one limit for both ingress rate limiting and storm control (including broadcast unknown unicast, multicast, and broadcast storms).

Parameters

These parameters are displayed in the web interface:

- **Interface** – Displays a list of ports or trunks.
- **Type** – Indicates interface type. (100Base-TX, 1000Base-T, or SFP)
- **Unknown Unicast** – Specifies storm control for unknown unicast traffic.
- **Multicast** – Specifies storm control for multicast traffic.
- **Broadcast** – Specifies storm control for broadcast traffic.
- **Status** – Enables or disables storm control. (Default: Disabled)
- **Rate** – Threshold level as a rate; i.e., kilobits per second.
  (Range: 64-100000 Kbps for Fast Ethernet ports,
  64-1000000 Kbps for Gigabit Ethernet ports)

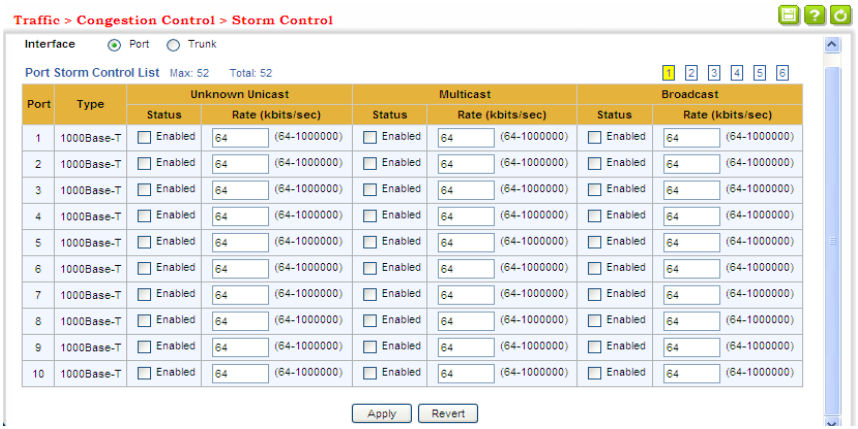
NOTE: Only one rate is supported for all traffic types on an interface.

Web Interface

To configure broadcast storm control:

1. Click RAFFIC > CONGESTION CONTROL > STORM CONTROL.
2. Set the STATUS field to enable or disable storm control.
3. Set the required threshold beyond which the switch will start dropping packets.
4. Click APPLY.

Figure 10-2. Configuring Storm Control



10-3 Automatic Traffic Control

Use the TRAFFIC > CONGESTION CONTROL > AUTO TRAFFIC CONTROL pages to configure bounding thresholds for broadcast and multicast storms which can automatically trigger rate limits or shut down a port.

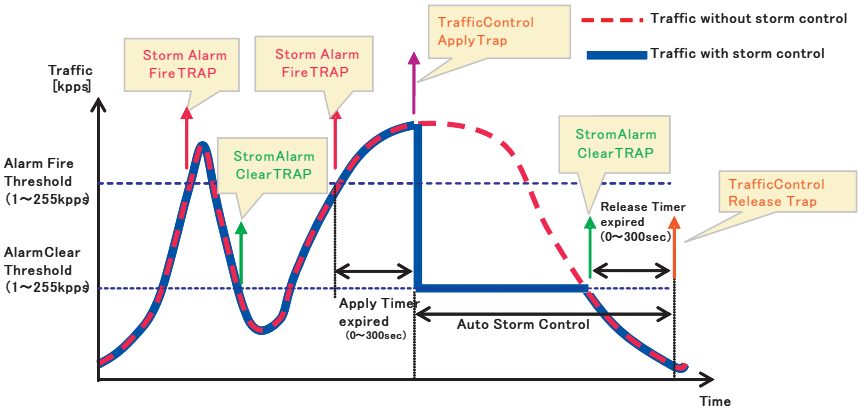
CLI References

See Chapter 32: "Automatic Traffic Control Commands" on page 32-1 for CLI reference information.

Command Usage

ATC includes storm control for broadcast or multicast traffic. The control response for either of these traffic types is the same, as shown in the following diagrams.

Figure 10-3. Storm Control by Limiting the Traffic Rate

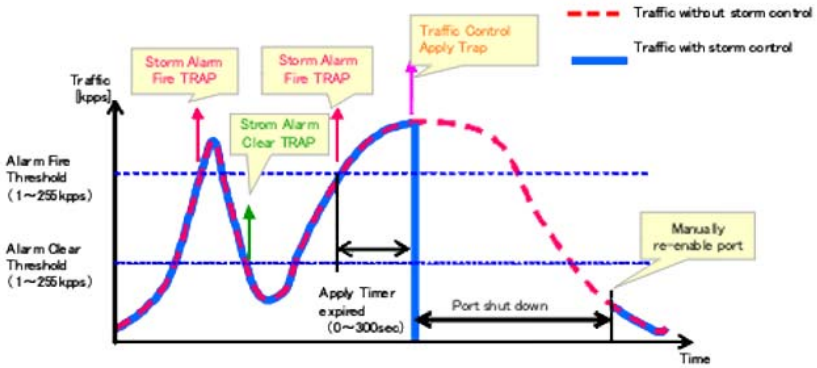


The key elements of this diagram are described below:

- Alarm Fire Threshold – The highest acceptable traffic rate. When ingress traffic exceeds the threshold, ATC sends a Storm Alarm Fire Trap and logs it.
- When traffic exceeds the alarm fire threshold and the apply timer expires, a traffic control response is applied, and a Traffic Control Apply Trap is sent and logged.
- Alarm Clear Threshold – The lower threshold beneath which a control response can be automatically terminated after the release timer expires. When ingress traffic falls below this threshold, ATC sends a Storm Alarm Clear Trap and logs it.
- When traffic falls below the alarm clear threshold after the release timer expires, traffic control (for rate limiting) will be stopped and a Traffic Control Release Trap sent and logged. Note that if the control action has shut down a port, it can only be manually re-enabled using Manual Control Release (see page 10-9).

- The traffic control response of rate limiting can be released automatically or manually. The control response of shutting down a port can only be released manually.

Figure 10-4. Storm Control by Shutting Down a Port



The key elements of this diagram are the same as that described in the preceding diagram, except that automatic release of the control response is not provided. When traffic control is applied, you must manually re-enable the port.

Functional Limitations

Automatic storm control is a software level control function. Traffic storms can also be controlled at the hardware level using Port Broadcast Control or Port Multicast Control (as described on page 10-4). However, only one of these control types can be applied to a port. Enabling automatic storm control on a port will disable hardware-level storm control on that port.

Setting the ATC Timers

Use the TRAFFIC > CONGESTION CONTROL > AUTO TRAFFIC CONTROL (CONFIGURE GLOBAL) page to set the time at which to apply the control response after ingress traffic has exceeded the upper threshold, and the time at which to release the control response after ingress traffic has fallen beneath the lower threshold.

CLI References

See "auto-traffic-control apply-timer" on page 32-2 and "auto-traffic-control release-timer" on page 32-3 for CLI reference information.

Command Usage

- After the apply timer expires, the settings in the TRAFFIC > AUTOMATIC TRAFFIC CONTROL (CONFIGURE INTERFACE) page are used to determine if a control action will be triggered (as configured under the ACTION field) or a trap message sent (as configured under the TRAP STORM FIRE field).
- The release timer only applies to a Rate Control response set in the ACTION FIELD OF THE ATC (INTEFACE CONFIGURATION) page. When a port has been shut down by a control response, it must be manually re-enabled using the Manual Control Release (see page 10-9).

Parameters

These parameters are displayed in the web interface:

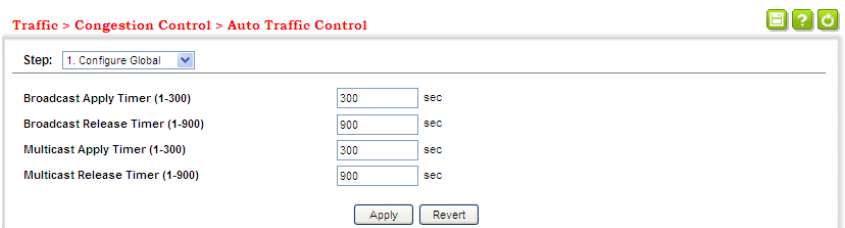
- **Broadcast Apply Timer** – The interval after the upper threshold has been exceeded at which to apply the control response to broadcast storms. (Range: 1-300 seconds; Default: 300 seconds)
- **Broadcast Release Timer** – The time at which to release the control response after ingress traffic has fallen beneath the lower threshold for broadcast storms. (Range: 1-900 seconds; Default: 900 seconds)
- **Multicast Apply Timer** – The interval after the upper threshold has been exceeded at which to apply the control response to multicast storms. (Range: 1-300 seconds; Default: 300 seconds)
- **Multicast Release Timer** – The time at which to release the control response after ingress traffic has fallen beneath the lower threshold for multicast storms. (Range: 1-900 seconds; Default: 900 seconds)

Web Interface

To configure the response timers for automatic storm control:

1. Click TRAFFIC > CONGESTION CONTROL > AUTO TRAFFIC CONTROL .
2. Select CONFIGURE GLOBAL from the Step field.
3. Set the apply and release timers for broadcast and multicast storms.
4. Click APPLY.

Figure 10-5. Configuring ATC Timers



Configuring ATC Thresholds and Responses

Use the TRAFFIC > CONGESTION CONTROL > AUTO TRAFFIC CONTROL (CONFIGURE INTERFACE) page to set the storm control mode (broadcast or multicast), the traffic thresholds, the control response, to automatically release a response of rate limiting, or to send related SNMP trap messages.

CLI References

See Chapter 32: "Automatic Traffic Control Commands" on page 32-1 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Storm Control** – Specifies automatic storm control for broadcast traffic or multicast traffic.

  Automatic storm control can be enabled for either broadcast or multicast traffic. It cannot be enabled for both of these traffic types at the same time.

- **Port** – Port identifier.

- **State** – Enables automatic traffic control for broadcast or multicast storms. (Default: Disabled)

  Automatic storm control is a software level control function. Traffic storms can also be controlled at the hardware level using the Storm Control menu. However, only one of these control types can be applied to a port. Enabling automatic storm control on a port will disable hardware-level storm control on that port.

- **Action** – When the Alarm Fire Threshold (upper threshold) is exceeded and the apply timer expires, one of the following control responses will be triggered.

  - **Rate Control** – The rate of ingress traffic is limited to the level set by the Alarm Clear Threshold. Rate limiting is discontinued only after the traffic rate has fallen beneath the Alarm Clear Threshold (lower threshold), and the release timer has expired. (This is the default response.)

  - **Shutdown** – The port is administratively disabled. A port disabled by automatic traffic control can only be manually re-enabled using the Manual Control Release attribute.

- **Auto Release Control** – Automatically stops a traffic control response of rate limiting when traffic falls below the alarm clear threshold and the release timer expires as illustrated in Figure 10-3: "Storm Control by Limiting the Traffic Rate" on page 10-6. When traffic control stops, the event is logged by the system and a Traffic Release Trap can be sent. (Default: Disabled)

  If automatic control release is not enabled and a control response of rate limiting has been triggered, you can manually stop the rate limiting response using the Manual Control Release attribute. If the control response has shut down a port, it can also be re-enabled using Manual Control Release.

- **Alarm Fire Threshold** – The upper threshold for ingress traffic beyond which a storm control response is triggered after the Apply Timer expires. (Range: 1-255 kilo-packets per second; Default: 128 Kpps)

  Once the traffic rate exceeds the upper threshold and the Apply Timer expires, a trap message will be sent if configured by the Trap Storm Fire attribute.

- **Alarm Clear Threshold** – The lower threshold for ingress traffic beneath which a control response for rate limiting will be released after the Release Timer expires, if so configured by the Auto Release Control attribute. (Range: 1-255 kilo-packets per second; Default: 128 Kpps)

  If rate limiting has been configured as a control response and Auto Control Release is enabled, rate limiting will be discontinued after the traffic rate has fallen beneath the lower threshold, and the Release Timer has expired. Note that if a port has been shut down by a control response, it will not be re-enabled by automatic traffic control. It can only be manually re-enabled using Manual Control Release.

  Once the traffic rate falls beneath the lower threshold and the Release Timer expires, a trap message will be sent if configured by the Trap Storm Clear attribute.

- **Trap Storm Fire** – Sends a trap when traffic exceeds the upper threshold for automatic storm control. (Default: Disabled)

- **Trap Storm Clear** – Sends a trap when traffic falls beneath the lower threshold after a storm control response has been triggered. (Default: Disabled)

- **Trap Traffic Apply** – Sends a trap when traffic exceeds the upper threshold for automatic storm control and the apply timer expires. (Default: Disabled)

- **Trap Traffic Release** – Sends a trap when traffic falls beneath the lower threshold after a storm control response has been triggered and the release timer expires. (Default: Disabled)

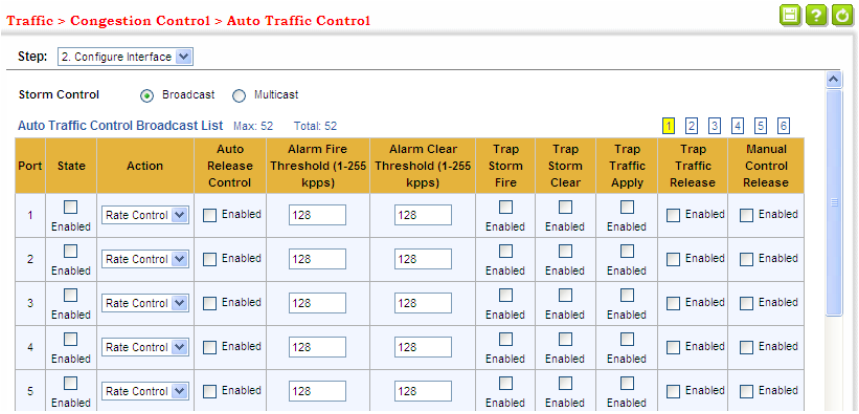
- **Manual Control Release** – Manually releases a control response of rate-limiting or port shutdown any time after the specified action has been triggered.

Web Interface

To configure the response timers for automatic storm control:

1. Click TRAFFIC > CONGESTION CONTROL > AUTOMATIC STORM CONTROL.
2. Select CONFIGURE INTERFACE from the STEP field.
3. Enable or disable ATC as required, set the control response, specify whether or not to automatically release the control response of rate limiting, set the upper and lower thresholds, and specify which trap messages to send.
4. Click APPLY.

Figure 10-6. Configuring ATC Interface Attributes


Traffic > Congestion Control > Auto Traffic Control
Step: 2. Configure Interface
Storm Control
Broadcast
Multicast
Auto Traffic Control Broadcast List Max: 52 Total: 52
1 2 3 4 5 6
Port
State
Action
Auto Release Control
Alarm Fire Threshold (1-255 kpps)
Alarm Clear Threshold (1-255 kpps)
Trap Storm Fire
Trap Storm Clear
Trap Traffic Apply
Trap Traffic Release
Manual Control Release
1 Enabled Rate Control Enabled 128 128 Enabled Enabled Enabled Enabled Enabled
2 Enabled Rate Control Enabled 128 128 Enabled Enabled Enabled Enabled Enabled
3 Enabled Rate Control Enabled 128 128 Enabled Enabled Enabled Enabled Enabled
4 Enabled Rate Control Enabled 128 128 Enabled Enabled Enabled Enabled Enabled
5 Enabled Rate Control Enabled 128 128 Enabled Enabled Enabled Enabled Enabled

Notes

Chapter 11
Class of Service

Class of Service (CoS) allows you to specify which data packets have greater precedence when traffic is buffered in the switch due to congestion. This switch supports CoS with four priority queues for each port. Data packets in a port's high-priority queue will be transmitted before those in the lower-priority queues. You can set the default priority for each interface, and configure the mapping of frame priority tags to the switch's priority queues.

This chapter describes the following basic topics:

- "Layer 2 Queue Settings" – Configures each queue, including the default priority, queue mode, queue weight, and mapping of packets to queues based on CoS tags.
- "Layer 3/4 Priority Settings" – Selects the method by which inbound packets are processed (DSCP or CoS), and sets the per-hop behavior and drop precedence for internal processing.

11-1 Layer 2 Queue Settings

This section describes how to configure the default priority for untagged frames, set the queue mode, set the weights assigned to each queue, and map class of service tags to queues.

Setting the Default Priority for Interfaces

Use the TRAFFIC > PRIORITY > DEFAULT PRIORITY page to specify the default port priority for each interface on the switch. All untagged packets entering the switch are tagged with the specified default port priority, and then sorted into the appropriate priority queue at the output port.

CLI References

See "switchport priority default" on page 36-5 for CLI reference information.

Command Usage

- This switch provides four priority queues for each port. It uses Weighted Round Robin to prevent head-of-queue blockage, but can be configured to process each queue in strict order, or use a combination of strict and weighted queueing.
- The default priority applies for an untagged frame received on a port set to accept all frame types (i.e, receives both untagged and tagged frames). This priority does not apply to IEEE 802.1Q VLAN tagged frames. If the incoming frame is an IEEE 802.1Q VLAN tagged frame, the IEEE 802.1p User Priority bits will be used.

- If the output port is an untagged member of the associated VLAN, these frames are stripped of all VLAN tags prior to transmission.

Parameters

These parameters are displayed in the web interface:

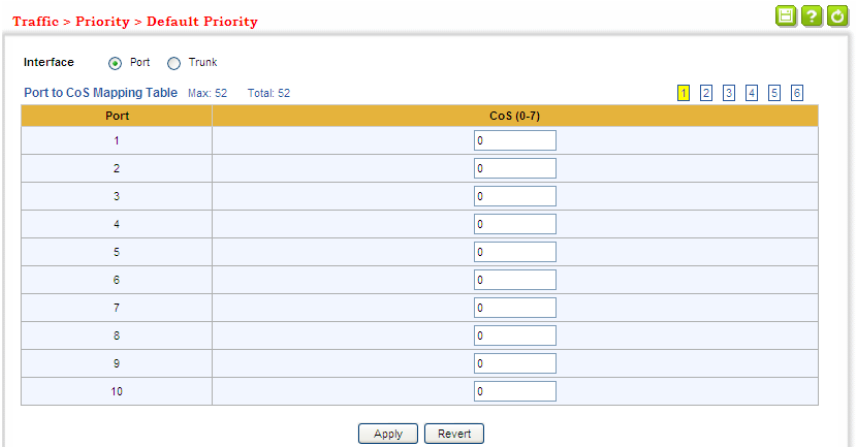
- **Interface** – Displays a list of ports or trunks.
- **CoS** – The priority that is assigned to untagged frames received on the specified interface. (Range: 0-7; Default: 0)

Web Interface

To configure the queue mode:

1. Click TRAFFIC > PRIORITY > DEFAULT PRIORITY.
2. Select the interface type to display (PORT or TRUNK).
3. Modify the default priority for any interface.
4. Click APPLY.

Figure 11-1. Setting the Default Port Priority



Selecting the Queue Mode

Use the TRAFFIC > PRIORITY > QUEUE page to set the queue mode for the egress queues on any interface. The switch can be set to service the queues based on a strict rule that requires all traffic in a higher priority queue to be processed before the lower priority queues are serviced, and Weighted Round-Robin (WRR) queuing that specifies a scheduling weight for each queue. It can also be configured to use a combination of strict and weighted queuing.

CLI References

See "queue mode" on page 36-2 and "show queue mode" on page 36-6 for CLI reference information.

Command Usage

- Strict priority requires all traffic in a higher priority queue to be processed before lower priority queues are serviced.
- WRR queuing specifies a relative weight for each queue. WRR uses a predefined relative weight for each queue that determines the percentage of service time the switch services each queue before moving on to the next queue. This prevents the head-of-line blocking that can occur with strict priority queuing.
- If Strict and WRR mode is selected, a combination of strict and weighted service is used as specified for each queue. Regardless of the selected mode, the queues are processed sequentially from high to lower priority (i.e., queues 3 to 0). The queues assigned to use strict priority should be specified using the Strict Mode field parameter.
- A weight can be assigned to each of the weighted queues (and thereby to the corresponding traffic priorities). This weight sets the frequency at which each queue is polled for service, and subsequently affects the response time for software applications assigned a specific priority value.
- Service time is shared at the egress ports by defining scheduling weights for WRR, or the queuing mode that uses a combination of strict and weighted queuing. Service time is allocated to each queue by calculating a precise number of bytes per second that will be serviced on each round.
- The specified queue mode applies to all interfaces.

Parameters

These parameters are displayed in the web interface:

- Queue Mode
  - **Strict** – Services the egress queues in sequential order, transmitting all traffic in the higher priority queues before servicing lower priority queues. This ensures that the highest priority packets are always serviced first, ahead of all other traffic.
  - **WRR** – Weighted Round-Robin shares bandwidth at the egress ports by using scheduling weights, servicing each queue in a round-robin fashion.
  - **Strict and WRR** – Uses strict or weighted service as specified for each queue. (This is the default setting.)
- **Queue ID** – The ID of the priority queue. (Range: 0-3)

- **Strict Mode** – If "Strict and WRR" mode is selected, then a combination of strict and weighted service is used as specified for each queue. Use this parameter to specify the queues assigned to use strict priority when using the strict-weighted queuing mode. (Default: Strict and WRR mode, with Queue 3 using strict mode)
- **Weight** – Sets a weight for each queue which is used by the WRR scheduler. (Range: 1-255; Default: Weights 1, 2, 4, 6 are assigned to queues 0 - 3 respectively)

Web Interface

To configure the queue mode:

1. Click TRAFFIC > PRIORITY > QUEUE.
2. Set the queue mode.
3. If the weighted queue mode is selected, the queue weight can be modified if required.
4. If the queue mode that uses a combination of strict and weighted queueing is selected, the queues which are serviced first must be specified by enabling strict mode parameter in the table.
5. Click APPLY.

Figure 11-2. Setting the Queue Mode (Strict)

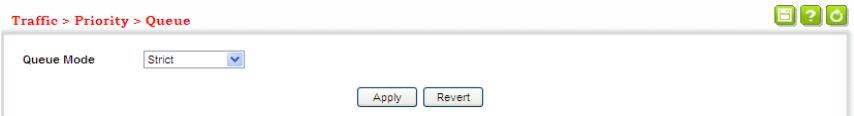


Figure 11-3. Setting the Queue Mode (WRR)

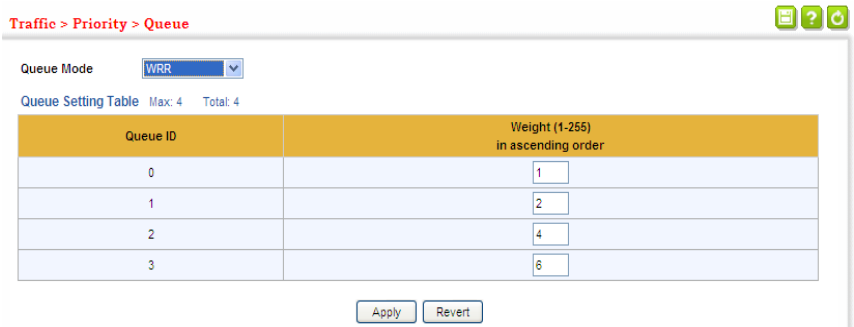
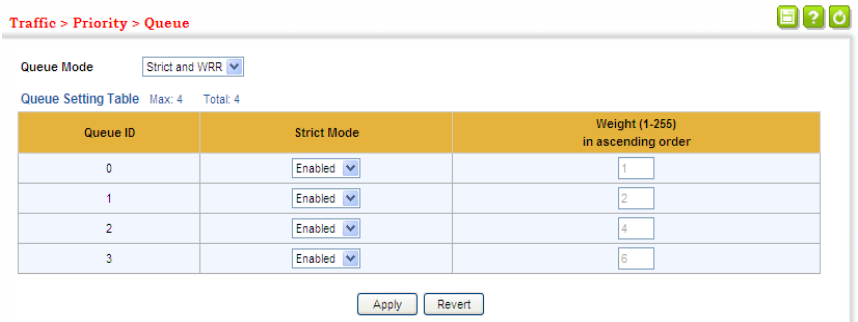


Figure 11-4. Setting the Queue Mode (Strict and WRR)



Mapping CoS Values to Egress Queues

Use the TRAFFIC > PRIORITY > PHB TO QUEUE page to specify the hardware output queues to use based on the internal per-hop behavior value. (For more information on exact manner in which the ingress priority tags are mapped to egress queues for internal processing, see "Mapping CoS Priorities to Internal DSCP Values" on page 11-11).

The switch processes Class of Service (CoS) priority tagged traffic by using four priority queues for each port, with service schedules based on strict priority, Weighted Round-Robin (WRR), or a combination of strict and weighted queuing. Up to eight separate traffic priorities are defined in IEEE 802.1p. Default priority levels are assigned according to recommendations in the IEEE 802.1p standard as shown in Table 11-1. This table indicates the default mapping of internal per-hop behavior to the hardware queues. The actual mapping may differ if the CoS priorities to internal DSCP values have been modified (page 11-11).

Table 11-1. IEEE 802.1p Egress Queue Priority Mapping

Priority	0	1	2	3	4	5	6	7
Queue	1	0	0	1	2	2	3	3

The priority levels recommended in the IEEE 802.1p standard for various network applications are shown in Table 11-2. However, priority levels can be mapped to the switch's output queues in any way that benefits application traffic for the network.

Table 11-2. CoS Priority Levels

Priority Level	**Traffic Type**
1	Background
2	(Spare)
0 (default)	Best Effort

Table 11-2. CoS Priority Levels (Continued)

Priority Level	Traffic Type
3	Excellent Effort
4	Controlled Load
5	Video, less than 100 milliseconds latency and jitter
6	Voice, less than 10 milliseconds latency and jitter
7	Network Control

CLI References

See "qos map phb-queue" on page 36-10 for CLI reference information.

Command Usage

- Egress packets are placed into the hardware queues according to the mapping defined by this command.
- The default internal PHB to output queue mapping is shown below.

Table 11-3. Mapping Internal Per-hop Behavior to Hardware Queues

Per-hop Behavior	0	1	2	3	4	5	6	7
Hardware Queues	1	0	0	1	2	2	3	3

- The specified mapping applies to all interfaces.

Parameters

These parameters are displayed in the web interface:

- **PHB** – Per-hop behavior, or the priority used for this router hop. (Range: 0-7, where 7 is the highest priority)
- **Queue** – Output queue buffer. (Range: 0-3, where 3 is the highest CoS priority queue)

Web Interface

To map internal PHB to hardware queues:

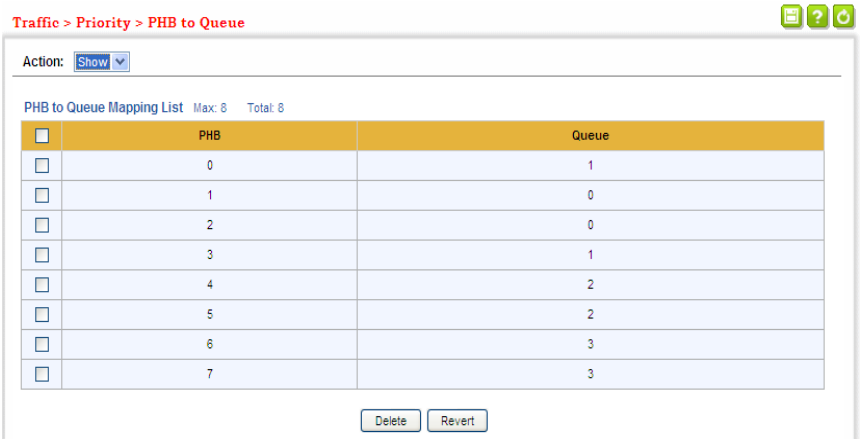
1. Click TRAFFIC > PRIORITY > PHB TO QUEUE.
2. Select ADD from the Action list.
3. Map an internal PHB to a hardware queue. Depending on how an ingress packet is processed internally based on its CoS value, and the assigned output queue, the mapping done on this page can effectively determine the service priority for different traffic classes.
4. Click APPLY.

Figure 11-5. Mapping CoS Values to Egress Queues

To show the internal PHB to hardware queue map:

1. Click TRAFFIC > PRIORITY > PHB TO QUEUE.
2. Select SHOW from the Action list.

Figure 11-6. Showing CoS Values to Egress Queue Mapping



11-2 Layer 3/4 Priority Settings

Mapping Layer 3/4 Priorities to CoS Values

The switch supports several common methods of prioritizing layer 3/4 traffic to meet application requirements. Traffic priorities can be specified in the IP header of a frame, using the priority bits in the Type of Service (ToS) octet, or the number of the TCP/UDP port. If priority bits are used, the ToS octet may contain three bits for IP Precedence or six bits for Differentiated Services Code Point (DSCP) service. When these services are enabled, the priorities are mapped to a Class of Service value by the switch, and the traffic then sent to the corresponding output queue.

Because different priority information may be contained in the traffic, this switch maps priority values to the output queues in the following manner – The precedence for priority mapping is DSCP Priority and then Default Port Priority.

NOTE: The default settings used for mapping priority values from ingress traffic to internal DSCP values are used to determine the hardware queues used for egress traffic, not to replace the priority values. These defaults are designed to optimize priority services for the majority of network applications. It should not be necessary to modify any of the default settings, unless a queuing problem occurs with a particular application.

Setting Priority Processing to DSCP or CoS

The switch allows a choice between using DSCP or CoS priority processing methods. Use the PRIORITY > TRUST MODE page to select the required processing method.

CLI References

See "qos map trust-mode" on page 36-12 for CLI reference information.

Command Usage

- If the QoS mapping mode is set to DSCP, and the ingress packet type is IPv4, then priority processing will be based on the DSCP value in the ingress packet.
- If the QoS mapping mode is set to DSCP, and a non-IP packet is received, the packet's CoS and CFI (Canonical Format Indicator) values are used for priority processing if the packet is tagged. For an untagged packet, the default port priority (see page 11-1) is used for priority processing.
- If the QoS mapping mode is set to CoS, and the ingress packet type is IPv4, then priority processing will be based on the CoS and CFI values in the ingress packet.

  For an untagged packet, the default port priority (see page 11-1) is used for priority processing.

Parameters

These parameters are displayed in the web interface:

- **Interface** – Specifies a port or trunk.
- Trust Mode
  - **DSCP** – Maps layer 3/4 priorities using Differentiated Services Code Point values. (This is the default setting.)
  - **CoS** – Maps layer 3/4 priorities using Class of Service values.

Web Interface

To configure the trust mode:

1. Click PRIORITY > TRUST MODE.
2. Select the interface type to display (PORT or TRUNK).
3. Set the trust mode.
4. Click APPLY.

Figure 11-7. Setting the Trust Mode

Mapping Ingress DSCP Values to Internal DSCP Values

Use the TRAFFIC > PRIORITY > DSCP TO DSCP page to map DSCP values in incoming packets to per-hop behavior and drop precedence values for internal priority processing.

The DSCP is six bits wide, allowing coding for up to 64 different forwarding behaviors. The DSCP replaces the ToS bits, but it retains backward compatibility with the three precedence bits so that non-DSCP compliant, ToS-enabled devices, will not conflict with the DSCP mapping. Based on network policies, different kinds of traffic can be marked for different kinds of forwarding.

CLI References

See "show qos map dscp-mutation" on page 36-13 for CLI reference information.

Command Usage

- Enter per-hop behavior and drop precedence for any of the DSCP values 0 - 63.

- This map is only used when the priority mapping mode is set to DSCP (see page 11-8), and the ingress packet type is IPv4.
- Two QoS domains can have different DSCP definitions, so the DSCP-to-PHB/Drop Precedence mutation map can be used to modify one set of DSCP values to match the definition of another domain. The mutation map should be applied at the receiving port (ingress mutation) at the boundary of a QoS administrative domain.
- Random Early Detection starts dropping yellow and red packets when the buffer fills up to 0x60 packets, and then starts dropping any packets regardless of color when the buffer fills up to 0x80 packets.
- The specified mapping applies to all interfaces.

Parameters

These parameters are displayed in the web interface:

- **DSCP** – DSCP value in ingress packets. (Range: 0-63)
- **PHB** – Per-hop behavior, or the priority used for this router hop. (Range: 0-7)
- **Drop Precedence** – Drop precedence used for Random Early Detection in controlling traffic congestion. (Range: 0 - Green, 3 - Yellow, 1 - Red)

Table 11-4. Default Mapping of DSCP Values to Internal PHB/Drop Values

ingress-dscp1[a] ingress-dscp10[b]	0	1	2	3	4	5	6	7	8	9
0	0,0	0,1	0,0	0,3	0,0	0,1	0,0	0,3	1,0	1,1
1	1,0	1,3	1,0	1,1	1,0	1,3	2,0	2,1	2,0	2,3
2	2,0	2,1	2,0	2,3	3,0	3,1	3,0	3,3	3.0	3,1
3	3,0	3,3	4,0	4,1	4,0	4,3	4,0	4,1	4.0	4,3
4	5,0	5,1	5,0	5,3	5,0	5,1	6,0	5,3	6,0	6,1
5	6,0	6,3	6,0	6,1	6,0	6,3	7,0	7,1	7.0	7,3
6	7,0	7,1	7,0	7,3						

a. The ingress DSCP is composed of ingress-dscp10 (most significant digit in the left column) and ingress-dscp1 (least significant digit in the top row (in other words, ingress-dscp = ingress-dscp10 * 10 + ingress-dscp1); and the corresponding internal-dscp is shown at the intersecting cell in the table.

b. The ingress DSCP is bitwise ANDed with the binary value 11 to determine the drop precedence. If the resulting value is 10 binary, then the drop precedence is set to 0.

Web Interface

To map DSCP values to internal PHB/drop precedence:

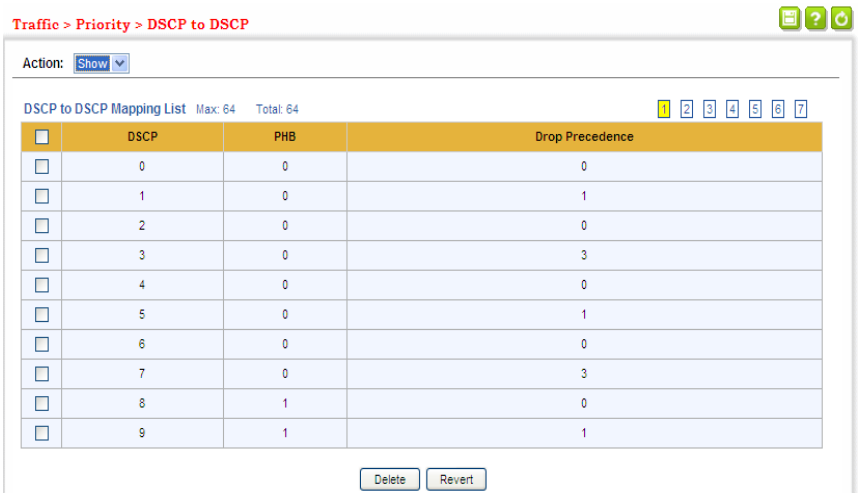
1. Click TRAFFIC > PRIORITY > DSCP TO DSCP.
2. Select ADD from the Action list.
3. Set the PHB and drop precedence for any DSCP value.
4. Click APPLY.

Figure 11-8. Configuring DSCP to DSCP Internal Mapping

To show the DSCP to internal PHB/drop precedence map:

1. Click TRAFFIC > PRIORITY > DSCP TO DSCP.
2. Select SHOW from the Action list.

Figure 11-9. Showing DSCP to DSCP Internal Mapping



Mapping CoS Priorities to Internal DSCP Values

Use the TRAFFIC > PRIORITY > COS TO DSCP page to maps CoS/CFI values in incoming packets to per-hop behavior and drop precedence values for priority processing.

CLI References

See "qos map cos-dscp" on page 36-7 for CLI reference information.

Command Usage

- The default mapping of CoS to PHB values is shown in Table 11-5: "Default Mapping of CoS/CFI to Internal PHB/Drop Precedence" on page 11-12.
- Enter up to eight CoS/CFI paired values, per-hop behavior and drop precedence.
- If a packet arrives with a 802.1Q header but it is not an IP packet, then the CoS/CFI-to-PHB/Drop Precedence mapping table is used to generate priority and drop precedence values for internal processing. Note that priority tags in the original packet are not modified by this command.
- The internal DSCP consists of three bits for per-hop behavior (PHB) which determines the queue to which a packet is sent; and two bits for drop precedence (namely color) which is used by Random Early Detection (RED) to control traffic congestion.
- RED starts dropping yellow and red packets when the buffer fills up to 16 packets on Fast Ethernet ports and 72 packets on Gigabit Ethernet ports, and then starts dropping any packets regardless of color when the buffer fills up to 58 packets on Fast Ethernet ports and 80 packets on Gigabit Ethernet ports.
- The specified mapping applies to all interfaces.

Parameters

These parameters are displayed in the web interface:

- **CoS** – CoS value in ingress packets. (Range: 0-7)
- **CFI** – Canonical Format Indicator. Set to this parameter to "0" to indicate that the MAC address information carried in the frame is in canonical format. (Range: 0-1)
- **PHB** – Per-hop behavior, or the priority used for this router hop. (Range: 0-7)
- **Drop Precedence** – Drop precedence used for Random Early Detection in controlling traffic congestion. (Range: 0 - Green, 3 - Yellow, 1 - Red)

Table 11-5. Default Mapping of CoS/CFI to Internal PHB/Drop Precedence

CFI CoS	0	1
0	(0,0)	(0,0)
1	(1,0)	(1,0)
2	(2,0)	(2,0)
3	(3,0)	(3,0)
4	(4,0)	(4,0)
5	(5,0)	(5,0)

Table 11-5. Default Mapping of CoS/CFI to Internal PHB/Drop Precedence

CFI CoS	0	1
6	(6,0)	(6,0)
7	(7,0)	(7,0)

Web Interface

To map CoS/CFI values to internal PHB/drop precedence:

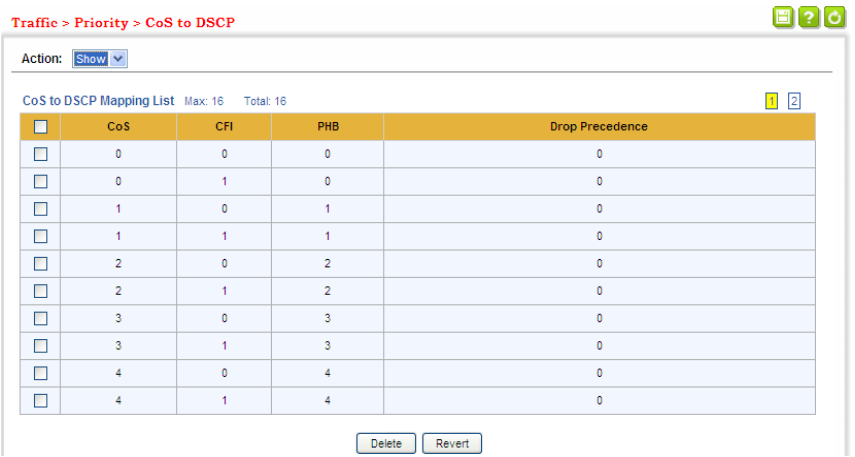
1. Click TRAFFIC > PRIORITY > COS TO DSCP.
2. Select ADD from the Action list.
3. Set the PHB and drop precedence for any of the CoS/CFI combinations.
4. Click APPLY.

Figure 11-10. Configuring CoS to DSCP Internal Mapping

To show the CoS/CFI to internal PHB/drop precedence map:

1. Click TRAFFIC > PRIORITY > COS TO DSCP.
2. Select SHOW from the Action list.
3. Select an interface.

Figure 11-11. Showing CoS to DSCP Internal Mapping



Chapter 12
Quality of Service

This chapter describes the following tasks required to apply QoS policies:

"Configuring a Class Map" – Creates a map which identifies a specific class of traffic.

"Creating QoS Policies"– Sets the boundary parameters used for monitoring inbound traffic, and the action to take for conforming and non-conforming traffic.

"Attaching a Policy Map to a Port"– Applies a policy map to an ingress port.

12-1 Overview

The commands described in this section are used to configure Quality of Service (QoS) classification criteria and service policies. Differentiated Services (DiffServ) provides policy-based management mechanisms used for prioritizing network resources to meet the requirements of specific traffic types on a per hop basis. Each packet is classified upon entry into the network based on access lists, IP Precedence, DSCP values, or VLAN lists. Using access lists allows you select traffic based on Layer 2, Layer 3, or Layer 4 information contained in each packet. Based on configured network policies, different kinds of traffic can be marked for different kinds of forwarding.

All switches or routers that access the Internet rely on class information to provide the same forwarding treatment to packets in the same class. Class information can be assigned by end hosts, or switches or routers along the path. Priority can then be assigned based on a general policy, or a detailed examination of the packet. However, note that detailed examination of packets should take place close to the network edge so that core switches and routers are not overloaded.

Switches and routers along the path can use class information to prioritize the resources allocated to different traffic classes. The manner in which an individual device handles traffic in the DiffServ architecture is called per-hop behavior. All devices along a path should be configured in a consistent manner to construct a consistent end-to-end QoS solution.

NOTE: You can configure up to 16 rules per class map. You can also include multiple classes in a policy map.

NOTE: You should create a class map before creating a policy map. Otherwise, you will not be able to select a class map from the policy rule settings screen (see page 12-5).

Command Usage

To create a service policy for a specific category or ingress traffic, follow these steps:

1. Use the Configure Class (Add) page to designate a class name for a specific category of traffic.
2. Use the Configure Class (Add Rule) page to edit the rules for each class which specify a type of traffic based on an access list, a DSCP or IP Precedence value, or a VLAN.
3. Use the Configure Policy (Add) page to designate a policy name for a specific manner in which ingress traffic will be handled.
4. Use the Configure Policy (Add Rule) page to add one or more classes to the policy map. Assign policy rules to each class by "setting" the QoS value (CoS or PHB) to be assigned to the matching traffic class. The policy rule can also be configured to monitor the maximum throughput and burst rate. Then specify the action to take for conforming traffic, or the action to take for a policy violation.
5. Use the Configure Interface page to assign a policy map to a specific interface.

12-2 Configuring a Class Map

A class map is used for matching packets to a specified class. Use the TRAFFIC > DIFFSERV (CONFIGURE CLASS) page to configure a class map.

CLI References

SeeChapter 37: "Quality of Service Commands" on page 37-1 for CLI reference information.

Command Usage

- The class map is used with a policy map (page 12-5) to create a service policy (page 12-14) for a specific interface that defines packet classification, service tagging, and bandwidth policing. Note that one or more class maps can be assigned to a policy map.
- Up to 32 class maps can be configured.

Parameters

These parameters are displayed in the web interface:

Add

- **Class Name** – Name of the class map. (Range: 1-32 characters)
- **Type** – Only one match command is permitted per class map, so the match-any field refers to the criteria specified on the Add page.
- **Description** – A brief description of a class map. (Range: 1-64 characters)

Add Rule

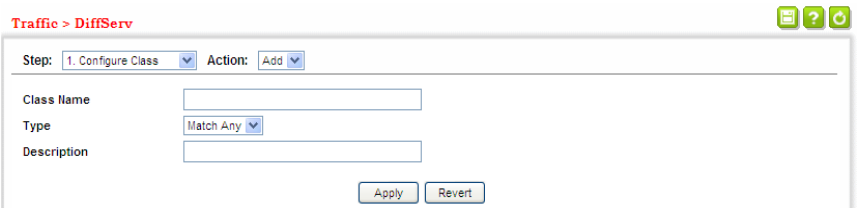
- **Class Name** – Name of the class map.
- **Type** – Only one match command is permitted per class map, so the match-any field refers to the criteria specified by the lone match command.
- **ACL** – Name of an access control list. Any type of ACL can be specified, including standard or extended IP ACLs and MAC ACLs.
- **IP DSCP** – A DSCP value. (Range: 0-63)
- **IP Precedence** – An IP Precedence value. (Range: 0-7)
- **VLAN ID** – A VLAN. (Range:1-4093)

Web Interface

To configure a class map:

1. Click TRAFFIC > DIFFSERV.
2. Select CONFIGURE CLASS from the Step list.
3. Select ADD from the Action list.
4. Enter a class name.
5. Enter a description.
6. Click ADD.

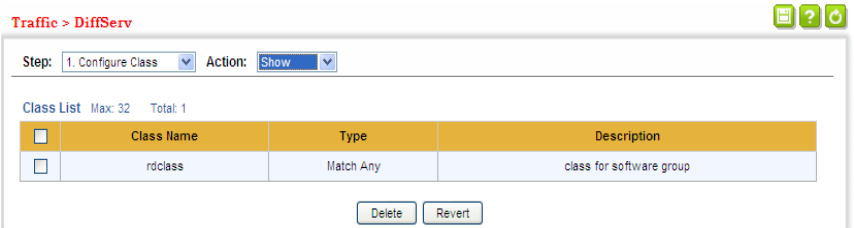
Figure 12-1. Configuring a Class Map



To show the configured class maps:

1. Click TRAFFIC > DIFFSERV.
2. Select CONFIGURE CLASS from the Step list.
3. Select SHOW from the Action list.

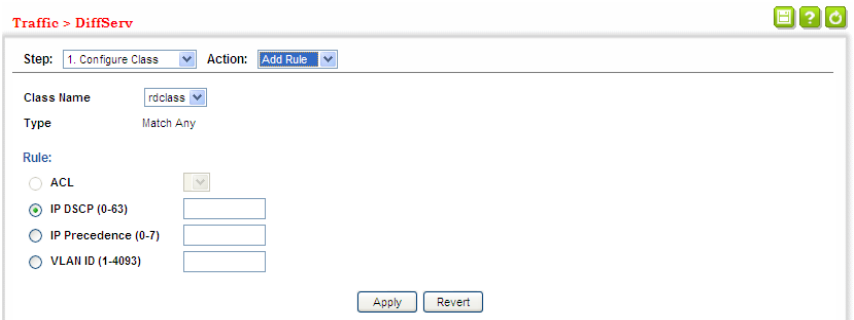
Figure 12-2. Showing Class Maps



To edit the rules for a class map:

1. Click TRAFFIC > DIFFSERV.
2. Select CONFIGURE CLASS from the Step list.
3. Select ADD RULE from the Action list.
4. Select the name of a class map.
5. Specify type of traffic for this class based on an access list, a DSCP or IP Precedence value, or a VLAN. You can specify up to 16 items to match when assigning ingress traffic to a class map.
6. Click APPLY.

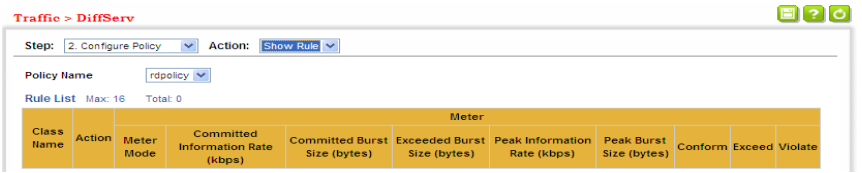
Figure 12-3. Adding Rules to a Class Map



To show the rules for a class map:

1. Click TRAFFIC > DIFFSERV..
2. Select CONFIGURE CLASS from the Step list.
3. Select SHOW RULE from the Action list.

Figure 12-4. Showing the Rules for a Class Map



12-3 Creating QoS Policies

Use the TRAFFIC > DIFFSERV (CONFIGURE POLICY) page to create a policy map that can be attached to multiple interfaces. A policy map is used to group one or more class map statements (page 12-2), modify service tagging, and enforce bandwidth policing. A policy map can then be bound by a service policy to one or more interfaces (page 12-14).

Configuring QoS policies requires several steps. A class map must first be configured which indicates how to match the inbound packets according to an access list, a DSCP or IP Precedence value, or a member of specific VLAN. A policy map is then configured which indicates the boundary parameters used for monitoring inbound traffic, and the action to take for conforming and non-conforming traffic. A policy map may contain one or more classes based on previously defined class maps.

The class of service or per-hop behavior (i.e., the priority used for internal queue processing) can be assigned to matching packets. In addition, the flow rate of inbound traffic can be monitored and the response to conforming and non-conforming traffic based by one of three distinct policing methods as described below.

Police Flow Meter – Defines the committed information rate (maximum throughput), committed burst size (burst rate), and the action to take for conforming and non-conforming traffic.

Policing is based on a token bucket, where bucket depth (that is, the maximum burst before the bucket overflows) is specified by the “burst” field (BC), and the average rate tokens are removed from the bucket is specified by the “rate” option (CIR). Action may be taken for traffic conforming to the maximum throughput, or exceeding the maximum throughput.

srTCM Police Meter – Defines an enforcer for classified traffic based on a single rate three color meter scheme defined in RFC 2697. This metering policy monitors a traffic stream and processes its packets according to the committed information rate (CIR, or maximum throughput), committed burst size (BC, or burst rate), and excess burst size (BE). Action may taken for traffic conforming to the maximum throughput, exceeding the maximum throughput, or exceeding the excess burst size.

- The PHB label is composed of five bits, three bits for per-hop behavior, and two bits for the color scheme used to control queue congestion. In addition to the actions defined by this command to transmit, remark the DSCP service value, or drop a packet, the switch will also mark the two color bits used to set the drop precedence of a packet for Random Early Detection. A packet is marked green if it doesn't exceed the committed information rate and committed burst size, yellow if it does exceed the committed information rate and committed burst size, but not the excess burst size, and red otherwise.
- The meter operates in one of two modes. In the color-blind mode, the meter assumes that the packet stream is uncolored. In color-aware mode the meter assumes that some preceding entity has pre-colored the incoming packet stream so that each packet is either green, yellow, or red. The marker (re)colors an IP packet according to the results of the meter. The color is coded in the DS field [RFC 2474] of the packet.
- The behavior of the meter is specified in terms of its mode and two token buckets, C and E, which both share the common rate CIR. The maximum size of the token bucket C is BC and the maximum size of the token bucket E is BE.

  The token buckets C and E are initially full, that is, the token count Tc(0) = BC and the token count Te(0) = BE. Thereafter, the token counts Tc and Te are updated CIR times per second as follows:

  - If Tc is less than BC, Tc is incremented by one, else
  - if Te is less then BE, Te is incremented by one, else
  - neither Tc nor Te is incremented.

  When a packet of size B bytes arrives at time t, the following happens if srTCM is configured to operate in Color-Blind mode:

  - If $Tc(t)-B \geq 0$, the packet is green and Tc is decremented by B down to the minimum value of 0, else
  - if $Te(t)-B \geq 0$, the packets is yellow and Te is decremented by B down to the minimum value of 0,
  - else the packet is red and neither Tc nor Te is decremented.

  When a packet of size B bytes arrives at time t, the following happens if srTCM is configured to operate in Color-Aware mode:

  - If the packet has been precolored as green and $Tc(t)-B \geq 0$, the packet is green and Tc is decremented by B down to the minimum value of 0, else
  - If the packet has been precolored as yellow or green and if $Te(t)-B \geq 0$, the packets is yellow and Te is decremented by B down to the minimum value of 0, else
  - the packet is red and neither Tc nor Te is decremented.

The metering policy guarantees a deterministic behavior where the volume of green packets is never smaller than what has been determined by the CIR and BC, that is, tokens of a given color are always spent on packets of that color. Refer to RFC 2697 for more information on other aspects of srTCM.

trTCM Police Meter – Defines an enforcer for classified traffic based on a two rate three color meter scheme defined in RFC 2698. This metering policy monitors a traffic stream and processes its packets according to the committed information rate (CIR, or maximum throughput), peak information rate (PIR), and their associated burst sizes – committed burst size (BC, or burst rate), and peak burst size (BP). Action may taken for traffic conforming to the maximum throughput, exceeding the maximum throughput, or exceeding the peak burst size.

- The PHB label is composed of five bits, three bits for per-hop behavior, and two bits for the color scheme used to control queue congestion. In addition to the actions defined by this command to transmit, remark the DSCP service value, or drop a packet, the switch will also mark the two color bits used to set the drop precedence of a packet for Random Early Detection. A packet is marked red if it exceeds the PIR. Otherwise it is marked either yellow or green depending on whether it exceeds or doesn't exceed the CIR.

  The trTCM is useful for ingress policing of a service, where a peak rate needs to be enforced separately from a committed rate.

- The meter operates in one of two modes. In the color-blind mode, the meter assumes that the packet stream is uncolored. In color-aware mode the meter assumes that some preceding entity has pre-colored the incoming packet stream so that each packet is either green, yellow, or red. The marker (re)colors an IP packet according to the results of the meter. The color is coded in the DS field [RFC 2474] of the packet.

- The behavior of the meter is specified in terms of its mode and two token buckets, P and C, which are based on the rates PIR and CIR, respectively. The maximum size of the token bucket P is BP and the maximum size of the token bucket C is BC.

  The token buckets P and C are initially (at time 0) full, that is, the token count Tp(0) = BP and the token count Tc(0) = BC. Thereafter, the token count Tp is incremented by one PIR times per second up to BP and the token count Tc is incremented by one CIR times per second up to BC.

  When a packet of size B bytes arrives at time t, the following happens if trTCM is configured to operate in Color-Blind mode:

  - If Tp(t)-B < 0, the packet is red, else
  - if Tc(t)-B < 0, the packet is yellow and Tp is decremented by B, else
  - the packet is green and both Tp and Tc are decremented by B.

  When a packet of size B bytes arrives at time t, the following happens if trTCM is configured to operate in Color-Aware mode:

  - If the packet has been precolored as red or if Tp(t)-B < 0, the packet is red, else

  - if the packet has been precolored as yellow or if Tc(t)-B < 0, the packet is yellow and Tp is decremented by B, else
  - the packet is green and both Tp and Tc are decremented by B.
- The trTCM can be used to mark a IP packet stream in a service, where different, decreasing levels of assurances (either absolute or relative) are given to packets which are green, yellow, or red. Refer to RFC 2698 for more information on other aspects of trTCM.

Random Early Detection – RED starts dropping yellow and red packets when the buffer fills up to 0x60 packets, and then starts dropping any packets regardless of color when the buffer fills up to 0x80 packets.

CLI References

SeeChapter 37: "Quality of Service Commands" on page 37-1 for CLI reference information.

Command Usage

- A policy map can contain 128 class statements that can be applied to the same interface (page 12-14). Up to 32 policy maps can be configured for ingress ports.
- After using the policy map to define packet classification, service tagging, and bandwidth policing, it must be assigned to a specific interface by a service policy (page 12-14) to take effect.

Parameters

These parameters are displayed in the web interface:

Add

- **Policy Name** – Name of policy map. (Range: 1-32 characters)
- **Description** – A brief description of a policy map. (Range: 1-64 characters)

Add Rule

- **Policy Name** – Name of policy map.
- **Class Name** – Name of a class map that defines a traffic classification upon which a policy can act.
- **Action** – This attribute is used to set an internal QoS value in hardware for matching packets. The PHB label is composed of five bits, three bits for per-hop behavior, and two bits for the color scheme used to control queue congestion with the srTCM and trTCM metering functions.
  - **Set CoS** – Configures the service provided to ingress traffic by setting an internal CoS value for a matching packet (as specified in rule settings for a class map). (Range: 0-7)

See Table 11-5: "Default Mapping of CoS/CFI to Internal PHB/Drop Precedence" on page 11-12).

- **Set PHB** – Configures the service provided to ingress traffic by setting the internal per-hop behavior for a matching packet (as specified in rule settings for a class map). (Range: 0-7)

  See Table 11-4: "Default Mapping of DSCP Values to Internal PHB/Drop Values" on page 11-10).

- **Set IP DSCP** – Configures the service provided to ingress traffic by setting an IP DSCP value for a matching packet (as specified in rule settings for a class map). (Range: 0-63)

- **Meter** – Check this to define the maximum throughput, burst rate, and the action that results from a policy violation.
- **Meter Mode** – Selects one of the following policing methods.
  - **Flow** (Police Flow) – Defines the committed information rate (CIR, or maximum throughput), committed burst size (BC, or burst rate), and the action to take for conforming and non-conforming traffic. Policing is based on a token bucket, where bucket depth (that is, the maximum burst before the bucket overflows) is specified by the “burst” field, and the average rate tokens are removed from the bucket is by specified by the “rate” option.
    - **Committed Information Rate** (CIR) – Rate in kilobits per second. (Range: 64-1000000 kbps at a granularity of 64 kbps or maximum port speed, whichever is lower)

      The rate cannot exceed the configured interface speed.

    - **Committed Burst Size** (BC) – Burst in bytes. (Range: 4000-16000000 at a granularity of 4k bytes)

      The burst size cannot exceed 16 Mbytes.

    - **Conform** – Specifies that traffic conforming to the maximum rate (CIR) will be transmitted without any change to the DSCP service level.
      - **Transmit** – Transmits in-conformance traffic without any change to the DSCP service level.
    - **Violate** – Specifies whether the traffic that exceeds the maximum rate (CIR) will be dropped or the DSCP service level will be reduced.
      - **Set IP DSCP** – Decreases DSCP priority for out of conformance traffic. (Range: 0-63)
      - **Drop** – Drops out of conformance traffic.

- **srTCM** (Police Meter) – Defines the committed information rate (CIR, or maximum throughput), committed burst size (BC, or burst rate) and excess burst size (BE), and the action to take for traffic conforming to the maximum throughput, exceeding the maximum throughput but within the excess burst size, or exceeding the excess burst size. In addition to the actions defined by this command to transmit, remark the DSCP service value, or drop a packet, the switch will also mark the two color bits used to set the drop precedence of a packet for Random Early Detection.

  The color modes include "Color-Blind" which assumes that the packet stream is uncolored, and "Color-Aware" which assumes that the incoming packets are pre-colored. The functional differences between these modes is described at the beginning of this section under "srTCM Police Meter."

  - **Committed Information Rate** (CIR) – Rate in kilobits per second. (Range: 64-1000000 kbps at a granularity of 64 kbps or maximum port speed, whichever is lower)

    The rate cannot exceed the configured interface speed.

  - **Committed Burst Size** (BC) – Burst in bytes. (Range: 4000-16000000 at a granularity of 4k bytes)

    The burst size cannot exceed 16 Mbytes.

  - **Exceeded Burst Size** (BE) – Burst in excess of committed burst size. (Range: 4000-16000000 at a granularity of 4k bytes)

    The burst size cannot exceed 16 Mbytes.

  - **Conform** – Specifies that traffic conforming to the maximum rate (CIR) will be transmitted without any change to the DSCP service level.

    - **Transmit** – Transmits in-conformance traffic without any change to the DSCP service level.

  - **Exceed** – Specifies whether traffic that exceeds the maximum rate (CIR) but is within the excess burst size (BE) will be dropped or the DSCP service level will be reduced.

    - **Set IP DSCP** – Decreases DSCP priority for out of conformance traffic. (Range: 0-63)

    - **Drop** – Drops out of conformance traffic.

  - **Violate** – Specifies whether the traffic that exceeds the excess burst size (BE) will be dropped or the DSCP service level will be reduced.

    - **Set IP DSCP** – Decreases DSCP priority for out of conformance traffic. (Range: 0-63)

    - **Drop** – Drops out of conformance traffic.

- **trTCM** (Police Meter) – Defines the committed information rate (CIR, or maximum throughput), peak information rate (PIR), and their associated burst sizes – committed burst size (BC, or burst rate) and peak burst size (BP), and the action to take for traffic conforming to the maximum throughput, exceeding the maximum throughput but within the peak information rate, or exceeding the peak information rate. In addition to the actions defined by this command to transmit, remark the DSCP service value, or drop a packet, the switch will also mark the two color bits used to set the drop precedence of a packet for Random Early Detection.

  The color modes include “Color-Blind” which assumes that the packet stream is uncolored, and “Color-Aware” which assumes that the incoming packets are pre-colored. The functional differences between these modes is described at the beginning of this section under “trTCM Police Meter.”

  - **Committed Information Rate** (CIR) – Rate in kilobits per second. (Range: 64-1000000 kbps at a granularity of 64 kbps or maximum port speed, whichever is lower)

    The rate cannot exceed the configured interface speed.

  - **Peak Information Rate** (PIR) – Rate in kilobits per second. (Range: 64-1000000 kbps at a granularity of 64 kbps or maximum port speed, whichever is lower)

    The rate cannot exceed the configured interface speed.

  - **Committed Burst Size** (BC) – Burst in bytes. (Range: 4000-16000000 at a granularity of 4k bytes)

    The burst size cannot exceed 16 Mbytes.

  - **Peak Burst Size** (BP) – Burst size in bytes. (Range: 4000-16000000 at a granularity of 4k bytes)

    The burst size cannot exceed 16 Mbytes.

  - **Conform** – Specifies that traffic conforming to the maximum rate (CIR) will be transmitted without any change to the DSCP service level.

    - **Transmit** – Transmits in-conformance traffic without any change to the DSCP service level.

  - **Exceed** – Specifies whether traffic that exceeds the maximum rate (CIR) but is within the peak information rate (PIR) will be dropped or the DSCP service level will be reduced.

    - **Set IP DSCP** – Decreases DSCP priority for out of conformance traffic. (Range: 0-63).

    - **Drop** – Drops out of conformance traffic.

  - **Violate** – Specifies whether the traffic that exceeds the peak information rate (PIR) will be dropped or the DSCP service level will be reduced.

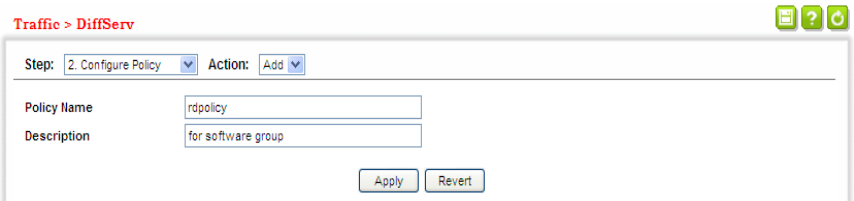
- **Set IP DSCP** – Decreases DSCP priority for out of conformance traffic. (Range: 0-63).
- **Drop** – Drops out of conformance traffic.

Web Interface

To configure a policy map:

1. Click TRAFFIC > DIFFSERV.
2. Select CONFIGURE POLICY from the Step list.
3. Select ADD from the Action list.
4. Enter a policy name.
5. Enter a description.
6. Click ADD.

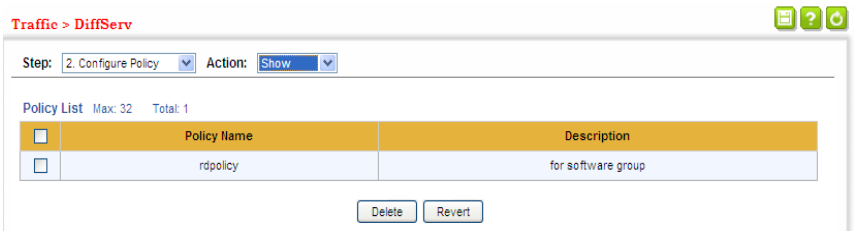
Figure 12-5. Configuring a Policy Map



To show the configured policy maps:

1. Click TRAFFIC > DIFFSERV.
2. Select CONFIGURE POLICY from the Step list.
3. Select SHOW from the Action list.

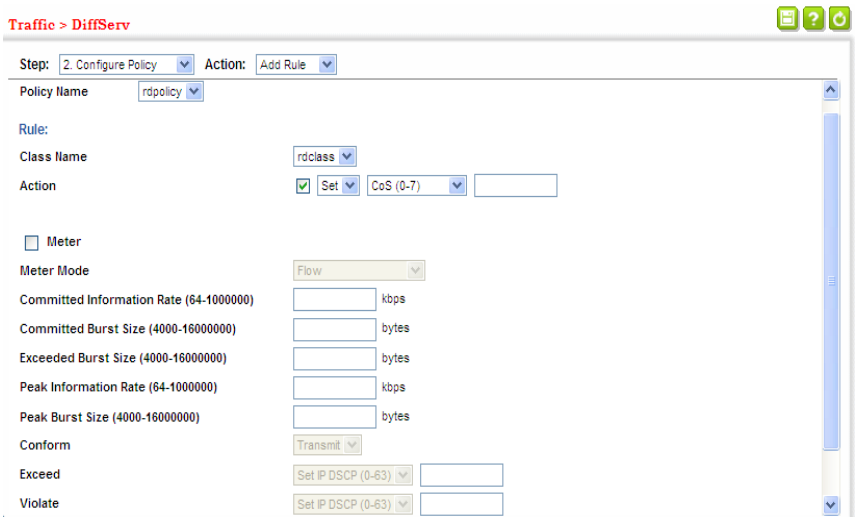
Figure 12-6. Showing Policy Maps



To edit the rules for a policy map:

1. Click TRAFFIC > DIFFSERV.
2. Select CONFIGURE POLICY from the Step list.
3. Select ADD RULE from the Action list.
4. Select the name of a policy map.
5. Set the CoS or per-hop behavior for matching packets to specify the quality of service to be assigned to the matching traffic class. Use one of the metering options to define parameters such as the maximum throughput and burst rate. Then specify the action to take for conforming traffic, the action to tack for traffic in excess of the maximum rate but within the peak information rate, or the action to take for a policy violation.
6. Click APPLY.

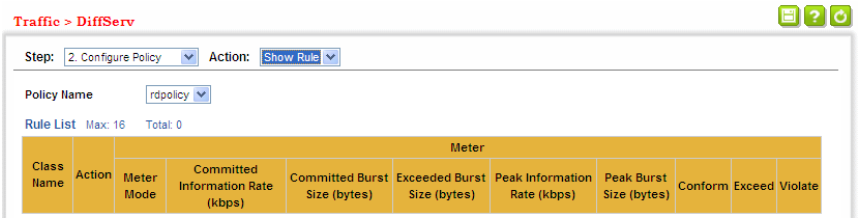
Figure 12-7. Adding Rules to a Policy Map



To show the rules for a policy map:

1. Click TRAFFIC > DIFFSERV.
2. Select CONFIGURE POLICY from the Step list.
3. Select SHOW RULE from the Action list.

Figure 12-8. Showing the Rules for a Policy Map



12-4 Attaching a Policy Map to a Port

Use the TRAFFIC > DIFFSERV (CONFIGURE INTERFACE) page to bind a policy map to an ingress port.

CLI References

SeeChapter 37: "Quality of Service Commands" on page 37-1 for CLI reference information.

Command Usage

- First define a class map, define a policy map, and bind the service policy to the required interface.
- Only one policy map can be bound to an interface.
- The switch does not allow a policy map to be bound to an interface for egress traffic.

Parameters

These parameters are displayed in the web interface:

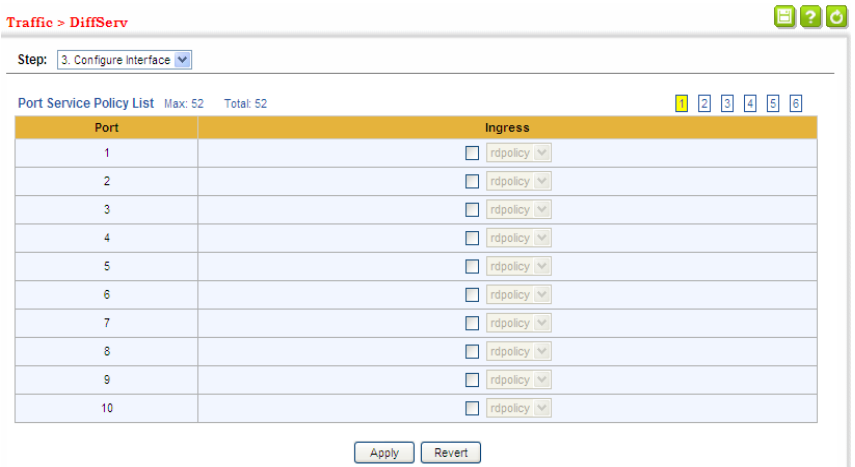
- **Port** – Specifies a port.
- **Ingress** – Applies the selected rule to ingress traffic.

Web Interface

To bind a policy map to a port:

1. Click TRAFFIC > DIFFSERV.
2. Select CONFIGURE INTERFACE from the Step list.
3. Check the box under the Ingress field to enable a policy map for a port.
4. Select a policy map from the scroll-down box.
5. Click APPLY.

Figure 12-9. Attaching a Policy Map to a Port



Chapter 13
VoIP Traffic Configuration

This chapter covers the following topics:

- "Configuring VoIP Traffic" – Configures VOIP globally, sets the Voice VLAN, and the aging time for attached ports.
- "Configuring Telephony OUI"– Configures the list of phones to be treated as VOIP devices based on the specified Organization Unit Identifier (OUI).
- "Configuring VoIP Traffic Ports" – Configures the way in which a port is added to the Voice VLAN, the filtering of non-VoIP packets, the method of detecting VoIP traffic, and the priority assigned to voice traffic.

13-1 Overview

When IP telephony is deployed in an enterprise network, it is recommended to isolate the Voice over IP (VoIP) network traffic from other data traffic. Traffic isolation can provide higher voice quality by preventing excessive packet delays, packet loss, and jitter. This is best achieved by assigning all VoIP traffic to a single Voice VLAN.

The use of a Voice VLAN has several advantages. It provides security by isolating the VoIP traffic from other data traffic. End-to-end QoS policies and high priority can be applied to VoIP VLAN traffic across the network, guaranteeing the bandwidth it needs. VLAN isolation also protects against disruptive broadcast and multicast traffic that can seriously affect voice quality.

The switch allows you to specify a Voice VLAN for the network and set a CoS priority for the VoIP traffic. The VoIP traffic can be detected on switch ports by using the source MAC address of packets, or by using LLDP (IEEE 802.1AB) to discover connected VoIP devices. When VoIP traffic is detected on a configured port, the switch automatically assigns the port as a tagged member the Voice VLAN. Alternatively, switch ports can be manually configured.

13-2 Configuring VoIP Traffic

Use the TRAFFIC > VOIP (CONFIGURE GLOBAL) page to configure the switch for VoIP traffic. First enable automatic detection of VoIP devices attached to the switch ports, then set the Voice VLAN ID for the network. The Voice VLAN aging time can also be set to remove a port from the Voice VLAN when VoIP traffic is no longer received on the port.

CLI References

See Section 35-10: "Configuring Voice VLANs" on page 35-35 for CLI reference information.

Command Usage

All ports are set to VLAN access mode by default. Prior to enabling VoIP for a port (by setting the VoIP mode to Auto or Manual as described below), first set the VLAN membership mode to hybrid (see "Adding Static Members to VLANs" on page 7-6).

Parameters

These parameters are displayed in the web interface:

- **Auto Detection Status** – Enables the automatic detection of VoIP traffic on switch ports. (Default: Disabled)
- **Voice VLAN** – Sets the Voice VLAN ID for the network. Only one Voice VLAN is supported and it must already be created on the switch. (Range: 1-4093)
- **Voice VLAN Aging Time** – The time after which a port is removed from the Voice VLAN when VoIP traffic is no longer received on the port. (Range: 5-43200 minutes; Default: 1440 minutes)

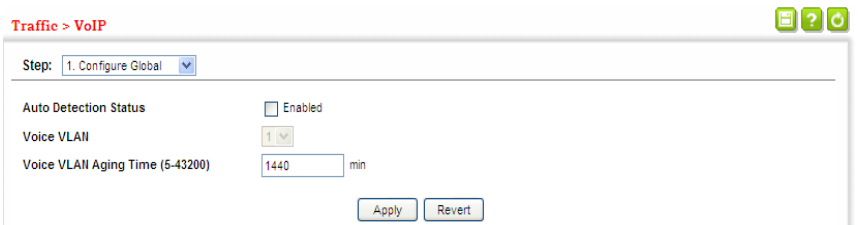
NOTE: The Voice VLAN ID cannot be modified when the global Auto Detection Status is enabled.

Web Interface

To configure global settings for a Voice VLAN:

1. Click TRAFFIC > VOIP.
2. Select CONFIGURE GLOBAL from the Step list.
3. Enable AUTO DETECTION.
4. Specify the VOICE VLAN ID.
5. Adjust the VOICE VLAN AGING TIME if required.
6. Click APPLY.

Figure 13-1. Configuring a Voice VLAN



13-3 Configuring Telephony OUI

VoIP devices attached to the switch can be identified by the manufacturer's Organizational Unique Identifier (OUI) in the source MAC address of received packets. OUI numbers are assigned to manufacturers and form the first three octets of device MAC addresses. The MAC OUI numbers for VoIP equipment can be configured on the switch so that traffic from these devices is recognized as VoIP. Use the TRAFFIC > VOIP (CONFIGURE OUI) page to configure this feature.

CLI References

See Section 35-10: "Configuring Voice VLANs" on page 35-35 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

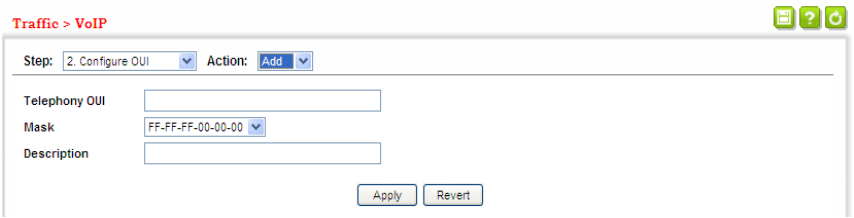
- **Telephony OUI** – Specifies a MAC address range to add to the list. Enter the MAC address in format 01-23-45-67-89-AB.
- **Mask** – Identifies a range of MAC addresses. Selecting a mask of FF-FF-FF-00-00-00 identifies all devices with the same OUI (the first three octets). Other masks restrict the MAC address range. Selecting FF-FF-FF-FF-FF-FF specifies a single MAC address. (Default: FF-FF-FF-00-00-00)
- **Description** – User-defined text that identifies the VoIP devices.

Web Interface

To configure MAC OUI numbers for VoIP equipment:

1. Click TRAFFIC > VOIP.
2. Select CONFIGURE OUI from the Step list.
3. Select ADD from the Action list.
4. Enter a MAC address that specifies the OUI for VoIP devices in the network.
5. Select a mask from the pull-down list to define a MAC address range.
6. Enter a description for the devices.
7. Click APPLY.

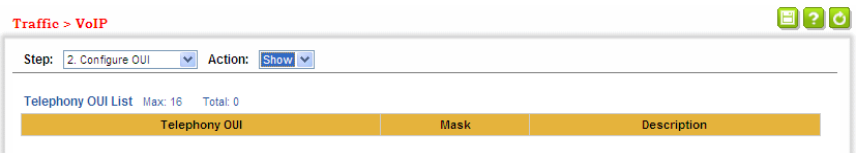
Figure 13-2. Configuring an OUI Telephony List



To show the MAC OUI numbers used for VoIP equipment:

1. Click TRAFFIC > VOIP.
2. Select CONFIGURE OUI from the Step list.
3. Select SHOW from the Action list.

Figure 13-3. Showing an OUI Telephony List



13-4 Configuring VoIP Traffic Ports

Use the TRAFFIC > VOIP (CONFIGURE INTERFACE) page to configure ports for VoIP traffic, you need to set the mode (Auto or Manual), specify the discovery method to use, and set the traffic priority. You can also enable security filtering to ensure that only VoIP traffic is forwarded on the Voice VLAN.

CLI References

See Section 35-10: "Configuring Voice VLANs" on page 35-35 for CLI reference information.

Command Usage

All ports are set to VLAN access mode by default. Prior to enabling VoIP for a port (by setting the VoIP mode to Auto or Manual as described below), first set the VLAN membership mode to hybrid (see "Adding Static Members to VLANs" on page 7-6).

Parameters

These parameters are displayed in the web interface:

- **Mode** – Specifies if the port will be added to the Voice VLAN when VoIP traffic is detected. (Default: None)
  - **None** – The Voice VLAN feature is disabled on the port. The port will not detect VoIP traffic or be added to the Voice VLAN.
  - **Auto** – The port will be added as a tagged member to the Voice VLAN when VoIP traffic is detected on the port. You must select a method for detecting VoIP traffic, either OUI or 802.1ab (LLDP). When OUI is selected, be sure to configure the MAC address ranges in the Telephony OUI list.
  - **Manual** – The Voice VLAN feature is enabled on the port, but the port must be manually added to the Voice VLAN.
- **Security** – Enables security filtering that discards any non-VoIP packets received on the port that are tagged with the voice VLAN ID. VoIP traffic is identified by source MAC addresses configured in the Telephony OUI list, or through LLDP that discovers VoIP devices attached to the switch. Packets received from non-VoIP sources are dropped. (Default: Disabled)
- **Discovery Protocol** – Selects a method to use for detecting VoIP traffic on the port. (Default: OUI)
  - **OUI** – Traffic from VoIP devices is detected by the Organizationally Unique Identifier (OUI) of the source MAC address. OUI numbers are assigned to manufacturers and form the first three octets of a device MAC address. MAC address OUI numbers must be configured in the Telephony OUI list so that the switch recognizes the traffic as being from a VoIP device.
  - **LLDP** – Uses LLDP (IEEE 802.1AB) to discover VoIP devices attached to the port. LLDP checks that the “telephone bit” in the system capability TLV is turned on. See Section 15-2: "Link Layer Discovery Protocol" on page 15-8 for more information on LLDP.
- **Priority** – Defines a CoS priority for port traffic on the Voice VLAN. The priority of any received VoIP packet is overwritten with the new priority when the Voice VLAN feature is active for the port. (Range: 0-6; Default: 6)
- **Remaining Age** – Number of minutes before this entry is aged out.

  The Remaining Age starts to count down when the OUI’s MAC address expires from the MAC address table. Therefore, the MAC address aging time should be added to the overall aging time. For example, if you configure the MAC adress table aging time to 30 seconds, and the voice VLAN aging time to 5 minutes, then after 5.5 minutes, a port will be removed from voice VLAN when VoIP traffic is no longer received on the port. Alternatively, if you clear the MAC address table manually, then the switch will also start counting down the Remaining Age.

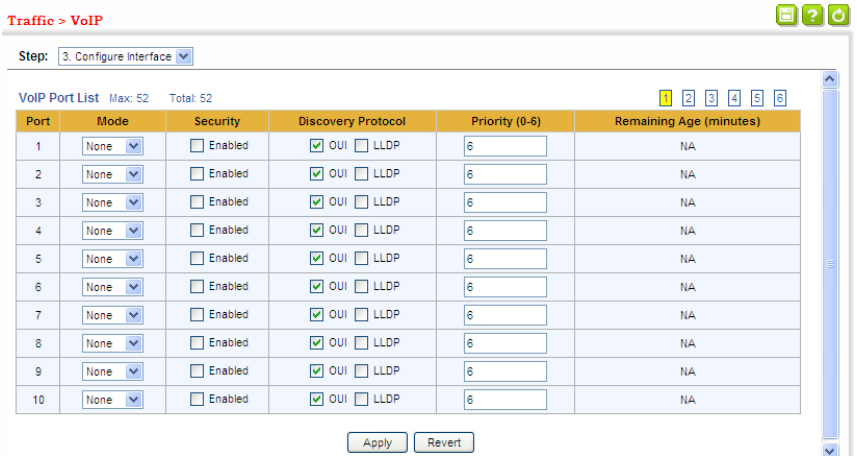
Web Interface

To configure VoIP traffic settings for a port:

1. Click TRAFFIC > VOIP.
2. Select CONFIGURE INTERFACE from the Step list.

3. Configure any required changes to the VoIP settings each port.
4. Click APPLY.

Figure 13-4. Configuring Port Settings for a Voice VLAN


Traffic > VoIP
Step: 3. Configure Interface
VoIP Port List Max: 52 Total: 52
1 2 3 4 5 6
Port
Mode
Security
Discovery Protocol
Priority (0-6)
Remaining Age (minutes)
1 None Enabled OUI LLDP 6 NA
2 None Enabled OUI LLDP 6 NA
3 None Enabled OUI LLDP 6 NA
4 None Enabled OUI LLDP 6 NA
5 None Enabled OUI LLDP 6 NA
6 None Enabled OUI LLDP 6 NA
7 None Enabled OUI LLDP 6 NA
8 None Enabled OUI LLDP 6 NA
9 None Enabled OUI LLDP 6 NA
10 None Enabled OUI LLDP 6 NA
Apply
Revert

Chapter 14
Security Measures

You can configure this switch to authenticate users logging into the system for management access using local or remote authentication methods. Port-based authentication using IEEE 802.1X can also be configured to control either management access to the uplink ports or client access to the data ports. This switch provides secure network management access using the following options:

- AAA Authorization and Accounting – Uses local or remote authentication to configure access rights, specify authentication servers, configure remote authentication and accounting.
- Configuring User Accounts – Manually configure access rights on the switch for specified users.
- Web Authentication – Allows stations to authenticate and access the network in situations where 802.1X or Network Access authentication methods are infeasible or impractical.
- Network Access (MAC Address Authentication) - Configure MAC authentication, intrusion response, dynamic VLAN assignment, and dynamic QoS assignment.
- Configuring HTTPS – Provide a secure web connection.
- Configuring the Secure Shell – Provide a secure shell (for secure Telnet access).
- Access Control Lists – Access Control Lists provide packet filtering for IP frames (based on address, protocol, Layer 4 protocol port number or TCP control code).
- ARP Inspection – Security feature that validates the MAC Address bindings for Address Resolution Protocol packets. Provides protection against ARP traffic with invalid MAC to IP Address bindings, which forms the basis for certain "man-in-the-middle" attacks.
- Filtering IP Addresses for Management Access – Filters management access to the web, SNMP or Telnet interface.
- Configuring Port Security – Configure secure addresses for individual ports.
- Configuring 802.1X Port Authentication – Use IEEE 802.1X port authentication to control access to specific ports.
- IP Source Guard – Filters untrusted DHCP messages on insecure ports by building and maintaining a DHCP snooping binding table.
- DHCP Snooping – Filter IP traffic on insecure ports for which the source address cannot be identified via DHCP snooping.

NOTE: The priority of execution for the filtering commands is Port Security, Port Authentication, Network Access, Web Authentication, Access Control Lists, IP Source Guard, and then DHCP Snooping.

14-1 AAA Authorization and Accounting

The Authentication, authorization, and accounting (AAA) feature provides the main framework for configuring access control on the switch. The three security functions can be summarized as follows:

- **Authentication** — Identifies users that request access to the network.
- **Authorization** — Determines if users can access specific services.
- **Accounting** — Provides reports, auditing, and billing for services that users have accessed on the network.

The AAA functions require the use of configured RADIUS or TACACS+ servers in the network. The security servers can be defined as sequential groups that are applied as a method for controlling user access to specified services. For example, when the switch attempts to authenticate a user, a request is sent to the first server in the defined group, if there is no response the second server will be tried, and so on. If at any point a pass or fail is returned, the process stops.

The switch supports the following AAA features:

- Accounting for IEEE 802.1X authenticated users that access the network through the switch.
- Accounting for users that access management interfaces on the switch through the console and Telnet.
- Accounting for commands that users enter at specific CLI privilege levels.
- Authorization of users that access management interfaces on the switch through the console and Telnet.

To configure AAA on the switch, you need to follow this general process:

1. Configure RADIUS and TACACS+ server access parameters. See "Configuring Local/Remote Logon Authentication" on page 14-3.
2. Define RADIUS and TACACS+ server groups to support the accounting and authorization of services.
3. Define a method name for each service to which you want to apply accounting or authorization and specify the RADIUS or TACACS+ server groups to use.
4. Apply the method names to port or line interfaces.

NOTE: This guide assumes that RADIUS and TACACS+ servers have already been configured to support AAA. The configuration of RADIUS and TACACS+ server software is beyond the scope of this guide, refer to the documentation provided with the RADIUS or TACACS+ server software.

Configuring Local/Remote Logon Authentication

Use the SECURITY > AAA > SYSTEM AUTHENTICATION page to specify local or remote authentication. Local authentication restricts management access based on user names and passwords manually configured on the switch. Remote authentication uses a remote access authentication server based on RADIUS or TACACS+ protocols to verify management access.

CLI References

See Section 24-2: "Authentication Sequence" on page 24-4 for CLI reference information.

Command Usage

- By default, management access is always checked against the authentication database stored on the local switch. If a remote authentication server is used, you must specify the authentication sequence. Then specify the corresponding parameters for the remote authentication protocol using the Security > AAA > Server page. Local and remote logon authentication control management access via the console port, web browser, or Telnet.
- You can specify up to three authentication methods for any user to indicate the authentication sequence. For example, if you select (1) RADIUS, (2) TACACS and (3) Local, the user name and password on the RADIUS server is verified first. If the RADIUS server is not available, then authentication is attempted using the TACACS+ server, and finally the local user name and password is checked.

Parameters

These parameters are displayed in the web interface:

- **Authentication Sequence** – Select the authentication, or authentication sequence required:
  - **Local** – User authentication is performed only locally by the switch.
  - **RADIUS** – User authentication is performed using a RADIUS server only.
  - **TACACS** – User authentication is performed using a TACACS+ server only.
  - **[authentication sequence]** – User authentication is performed by up to three authentication methods in the indicated sequence.

Web Interface

To configure the method(s) of controlling management access:

1. Click SECURITY > AAA > SYSTEM AUTHENTICATION.
2. Specify the authentication sequence (i.e., one to three methods).
3. Click APPLY.

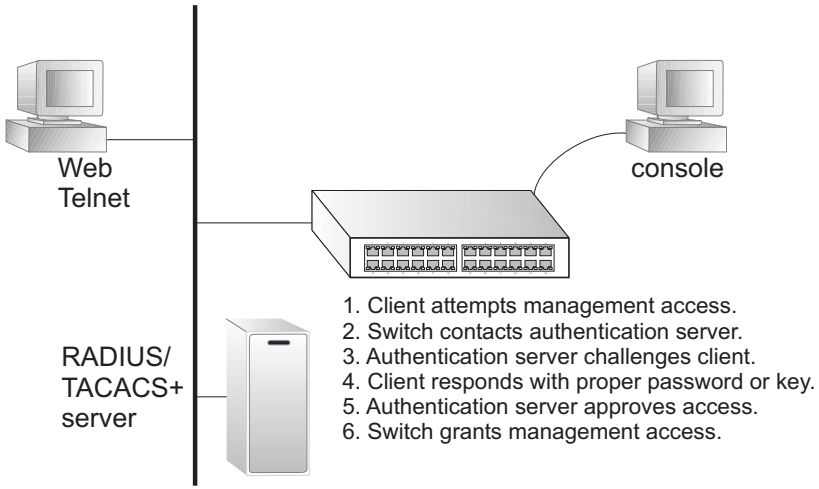
Figure 14-1. Configuring the Authentication Sequence

Configuring Remote Logon Authentication Servers

Use the SECURITY > AAA > SERVER page to configure the message exchange parameters for RADIUS or TACACS+ remote access authentication servers.

Remote Authentication Dial-in User Service (RADIUS) and Terminal Access Controller Access Control System Plus (TACACS+) are logon authentication protocols that use software running on a central server to control access to RADIUS-aware or TACACS-aware devices on the network. An authentication server contains a database of multiple user name/password pairs with associated privilege levels for each user that requires management access to the switch.

Figure 14-2. Authentication Server Operation



RADIUS uses UDP while TACACS+ uses TCP. UDP only offers best effort delivery, while TCP offers a connection-oriented transport. Also, note that RADIUS encrypts only the password in the access-request packet from the client to the server, while TACACS+ encrypts the entire body of the packet.

CLI References

See Section 24-3: "RADIUS Client" on page 24-7, Section 24-4: "TACACS+ Client" on page 24-13 and Section 24-5: "AAA" on page 24-16 for CLI reference information.

Command Usage

- If a remote authentication server is used, you must specify the message exchange parameters for the remote authentication protocol. Both local and remote logon authentication control management access via the console port, web browser, or Telnet.
- RADIUS and TACACS+ logon authentication assign a specific privilege level for each user name/password pair. The user name, password, and privilege level must be configured on the authentication server. The encryption methods used for the authentication process must also be configured or negotiated between the authentication server and logon client. This switch can pass authentication messages between the server and client that have been encrypted using MD5 (Message-Digest 5), TLS (Transport Layer Security), or TTLS (Tunneled Transport Layer Security).

Parameters

These parameters are displayed in the web interface:

Configure Server

- RADIUS
  - **Global** – Provides globally applicable RADIUS settings.
  - **Server Index** – Specifies one of five RADIUS servers that may be configured. The switch attempts authentication using the listed sequence of servers. The process ends when a server either approves or denies access to a user.
  - **Server IP Address** – Address of authentication server.
    (A Server Index entry must be selected to display this item.)
  - **Accounting Server UDP Port** – Network (UDP) port on authentication server used for accounting messages.
    (Range: 1-65535; Default: 1813)
  - **Authentication Server UDP Port** – Network (UDP) port on authentication server used for authentication messages.
    (Range: 1-65535; Default: 1812)
  - **Authentication Timeout** – The number of seconds the switch waits for a reply from the RADIUS server before it resends the request. (Range: 1-65535; Default: 5)
  - **Authentication Retries** – Number of times the switch tries to authenticate logon access via the authentication server. (Range: 1-30; Default: 2)
  - **Set Key** – Mark this box to set or modify the encryption key.

- **Authentication Key** – Encryption key used to authenticate logon access for client. Do not use blank spaces in the string. (Maximum length: 48 characters)
- **Confirm Authentication Key** – Re-type the string entered in the previous field to ensure no errors were made. The switch will not change the encryption key if these two fields do not match.

- TACACS+
  - **Global** – Provides globally applicable TACACS+ settings.
  - **Server Index** – Specifies the index number of the server to be configured. The switch currently supports only one TACACS+ server.
  - **Server IP Address** – Address of the TACACS+ server.
    (A Server Index entry must be selected to display this item.)
  - **Authentication Timeout** – The number of seconds the switch waits for a reply from the TACACS+ server before it resends the request. (Range: 1-540; Default: 5)
  - **Authentication Server TCP Port** – Network (TCP) port of TACACS+ server used for authentication messages.
    (Range: 1-65535; Default: 49)
  - **Set Key** – Mark this box to set or modify the encryption key.
  - **Authentication Key** – Encryption key used to authenticate logon access for client. Do not use blank spaces in the string. (Maximum length: 48 characters)
  - **Confirm Authentication Key** – Re-type the string entered in the previous field to ensure no errors were made. The switch will not change the encryption key if these two fields do not match.

Configure Group

- **Server Type** – Select RADIUS or TACACS+ server.
- **Group Name** - Defines a name for the RADIUS or TACACS+ server group. (Range: 1-255 characters)
- **Sequence at Priority** - Specifies the RADIUS server and sequence to use for the group. (Range: 1-5)

  When specifying the priority sequence for a sever, the server index must already be defined (see "Configuring Local/Remote Logon Authentication" on page 14-3).

Web Interface

To configure the parameters for RADIUS or TACACS+ authentication:

1. Click SECURITY > AAA > SERVER.
2. Select CONFIGURE SERVER from the Step list.
3. Select RADIUS or TACACS+ server type.

4. Select GLOBAL to specify the parameters that apply globally to all specified servers, or select a specific Server Index to specify the parameters that apply to a specific server.
5. To set or modify the authentication key, mark the SET KEY box, enter the key, and then confirm it
6. Click APPLY.

Figure 14-3. Configuring Remote Authentication Server (RADIUS)

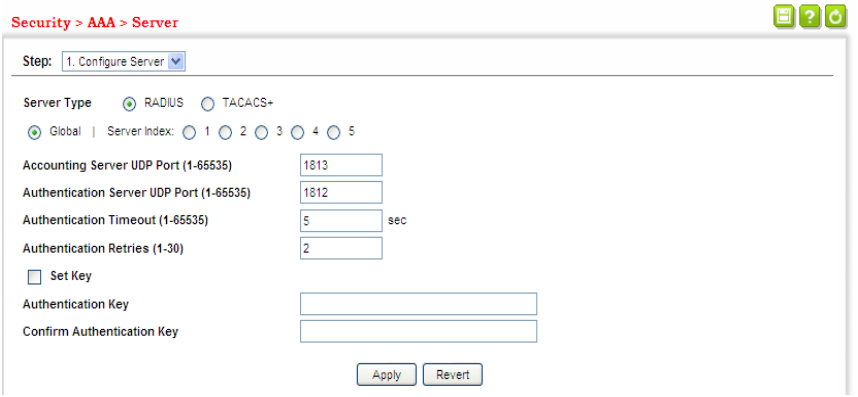
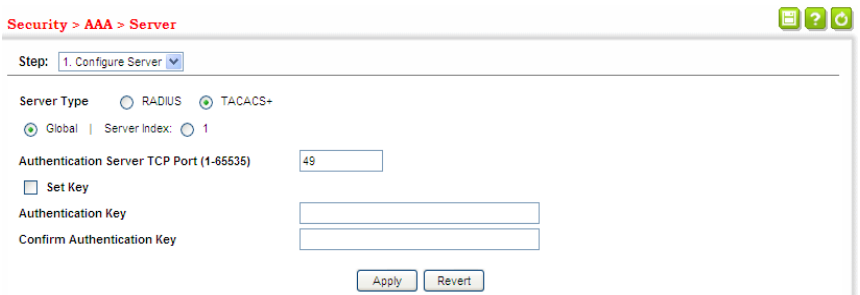

Security > AAA > Server
Step: 1. Configure Server
Server Type RADIUS TACACS+
Global | Server Index: 1 2 3 4 5
Accounting Server UDP Port (1-65535) 1813
Authentication Server UDP Port (1-65535) 1812
Authentication Timeout (1-65535) 5 sec
Authentication Retries (1-30) 2
Set Key
Authentication Key
Confirm Authentication Key
Apply Revert

Figure 14-4. Configuring Remote Authentication Server (TACACS+)

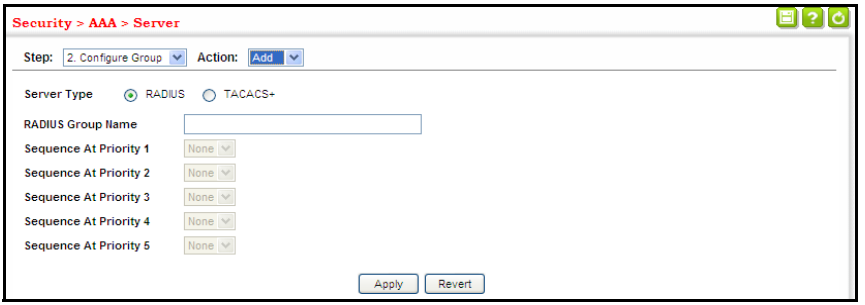


To configure the RADIUS or TACACS+ server groups to use for accounting and authorization:

1. Click SECURITY > AAA > SERVER.
2. Select CONFIGURE GROUP from the Step list.
3. Select ADD from the Action list.
4. Select RADIUS or TACACS+ server type.

5. Enter the group name, followed by the index of the server to use for each priority level.
6. Click APPLY.

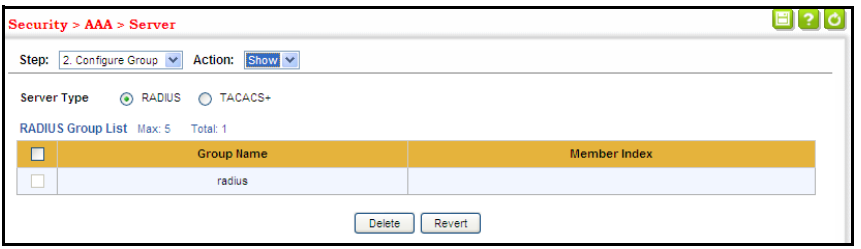
Figure 14-5. Configuring AAA Server Groups



To show the RADIUS or TACACS+ server groups used for accounting and authorization:

1. Click SECURITY > AAA > SERVER.
2. Select CONFIGURE GROUP from the Step list.
3. Select SHOW from the Action list.

Figure 14-6. Showing AAA Server Groups



Configuring AAA Accounting

Use the SECURITY > AAA > ACCOUNTING page to enable accounting of requested services for billing or security purposes, and also to display the configured accounting methods, the methods applied to specific interfaces, and basic accounting information recorded for user sessions.

CLI References

See Section 24-5: "AAA" on page 24-16 for CLI reference information.

Command Usage

AAA authentication through a RADIUS or TACACS+ server must be enabled before accounting is enabled.

Parameters

These parameters are displayed in the web interface:

Configure Global

- **Periodic Update** - Specifies the interval at which the local accounting service updates information for all users on the system to the accounting server. (Range: 0-2147483647 minutes; where 0 means disabled)

Configure Method

- **Accounting Type** – Specifies the service as:
  - **802.1X** – Accounting for end users.
  - **Exec** – Administrative accounting for local console, Telnet, or SSH connections.
- **Method Name** – Specifies an accounting method for service requests. The “default” methods are used for a requested service if no other methods have been defined. (Range: 1-255 characters)

  Note that the method name is only used to describe the accounting method configured on the specified RADIUS or TACACS+ servers. No information is sent to the servers about the method to use.
- **Accounting Notice** – Records user activity from log-in to log-off point.
- **Server Group Name** - Specifies the accounting server group. (Range: 1-255 characters)

  The group names “radius” and “tacacs+” specifies all configured RADIUS and TACACS+ hosts (see "Configuring Local/Remote Logon Authentication" on page 14-3). Any other group name refers to a server group configured on the SECURITY > AAA > SERVER (CONFIGURE GROUP) page.

Configure Service

- **Accounting Type** – Specifies the service as 802.1X, Command or Exec as described in the preceding section.
- 802.1X
  - **Method Name** – Specifies a user defined accounting method to apply to an interface. This method must be defined in the Configure Method page. (Range: 1-255 characters)
- **Exec**
  - **Console Method Name** – Specifies a user defined method name to apply to console connections.
  - **Telnet Method Name** – Specifies a user defined method name to apply to Telnet connections.

Show Information – Summary

- **Accounting Type** - Displays the accounting service.
- **Method Name** - Displays the user-defined or default accounting method.
- **Server Group Name** - Displays the accounting server group.
- **Interface** - Displays the port, console or Telnet interface to which these rules apply. (This field is null if the accounting method and associated server group has not been assigned to an interface.)

Show Information – Statistics

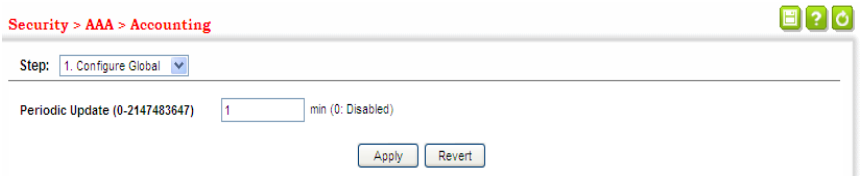
- **User Name** - Displays a registered user name.
- **Accounting Type** - Displays the accounting service.
- **Interface** - Displays the receive port number through which this user accessed the switch.
- **Time Elapsed** - Displays the length of time this entry has been active.

Web Interface

To configure global settings for AAA accounting:

1. Click SECURITY > AAA > ACCOUNTING.
2. Select CONFIGURE GLOBAL from the Step list.
3. Enter the required update interval.
4. Click APPLY.

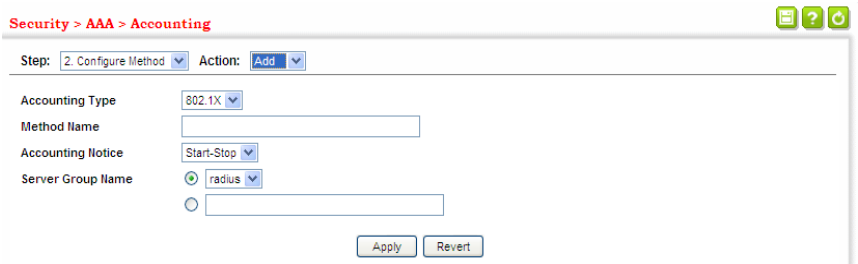
Figure 14-7. Configuring Global Settings for AAA Accounting



To configure the accounting method applied to various service types and the assigned server group:

1. Click SECURITY > AAA > ACCOUNTING.
2. Select CONFIGURE METHOD from the Step list.
3. Select ADD from the Action list.
4. Select the accounting type (802.1X, EXEC).
5. Specify the name of the accounting method and server group name.
6. Click APPLY.

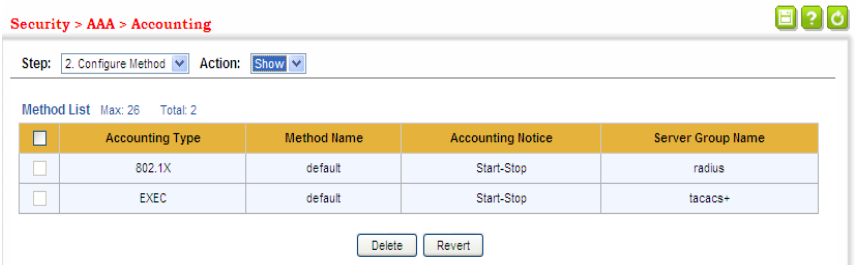
Figure 14-8. Configuring AAA Accounting Methods



To show the accounting method applied to various service types and the assigned server group:

1. Click SECURITY > AAA > ACCOUNTING.
2. Select CONFIGURE METHOD from the Step list.
3. Select SHOW from the Action list.

Figure 14-9. Showing AAA Accounting Methods



To configure the accounting method applied to specific interfaces, console commands entered at specific privilege levels, and local console, Telnet, or SSH connections:

1. Click SECURITY > AAA > ACCOUNTING.
2. Select CONFIGURE SERVICE from the Step list.
3. Select the accounting type (802.1X, EXEC).
4. Enter the required accounting method.
5. Click APPLY.

Figure 14-10. Configuring AAA Accounting Service for 802.1X Service

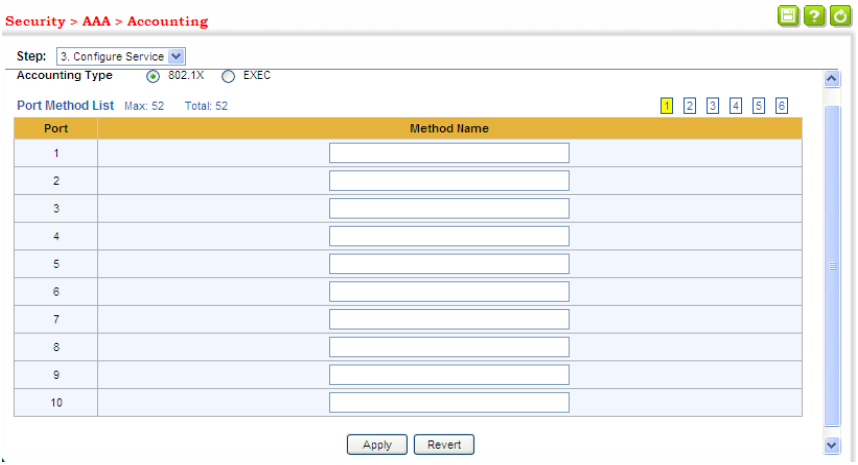
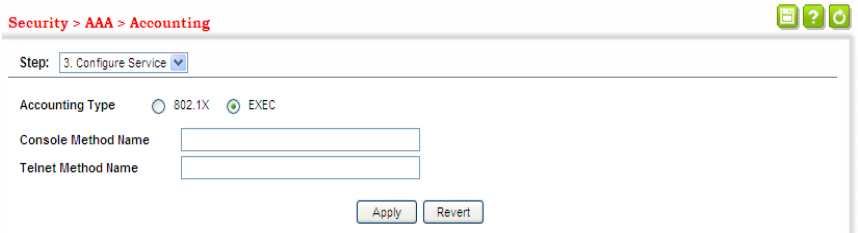


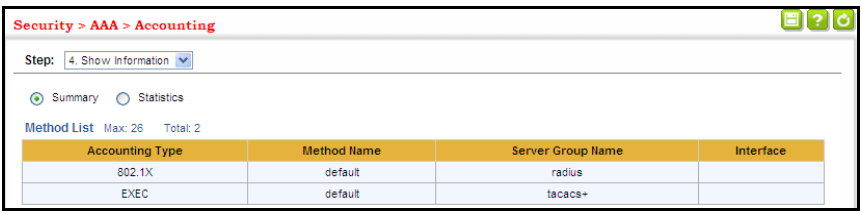
Figure 14-11. Configuring AAA Accounting Service for Exec Service



To display a summary of the configured accounting methods and assigned server groups for specified service types:

1. Click SECURITY > AAA > ACCOUNTING.
2. Select SHOW INFORMATION from the Step list.
3. Click SUMMARY.

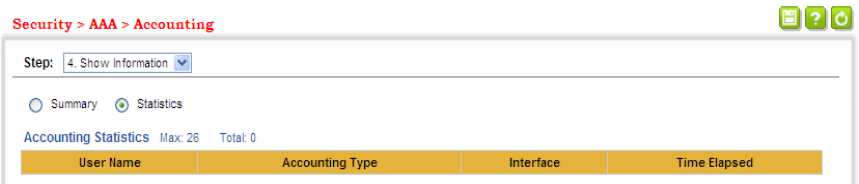
Figure 14-12. Displaying a Summary of Applied AAA Accounting



To display basic accounting information and statistics recorded for user sessions:

1. Click SECURITY > AAA > ACCOUNTING.
2. Select SHOW INFORMATION from the Step list.
3. Click STATISTICS.

Figure 14-13. Displaying Statistics for AAA Accounting Sessions



Configuring AAA Authorization

Use the SECURITY > AAA > AUTHORIZATION page to enable authorization of requested services, and also to display the configured authorization methods, and the methods applied to specific interfaces.

CLI References

See Section 24-5: "AAA" on page 24-16 for CLI reference information.

Command Usage

- This feature performs authorization to determine if a user is allowed to run an Exec shell.
- AAA authentication through a RADIUS or TACACS+ server must be enabled before authorization is enabled.

Parameters

These parameters are displayed in the web interface:

Configure Method

- **Authorization Type** – Specifies the service as Exec, indicating administrative authorization for local console, Telnet, or SSH connections.
- **Method Name** – Specifies an authorization method for service requests. The "default" method is used for a requested service if no other methods have been defined. (Range: 1-255 characters)
- **Server Group Name** - Specifies the authorization server group. (Range: 1-255 characters)

  The group name "tacacs+" specifies all configured TACACS+ hosts (see "Configuring Local/Remote Logon Authentication" on page 14-3). Any other group name refers to a server group configured on the TACACS+ Group Settings page. Authorization is only supported for TACACS+ servers.

Configure Service

- **Console Method Name** – Specifies a user defined method name to apply to console connections.
- **Telnet Method Name** – Specifies a user defined method name to apply to Telnet connections.

Show Information

- **Authorization Type** - Displays the authorization service.
- **Method Name** - Displays the user-defined or default accounting method.
- **Server Group Name** - Displays the authorization server group.

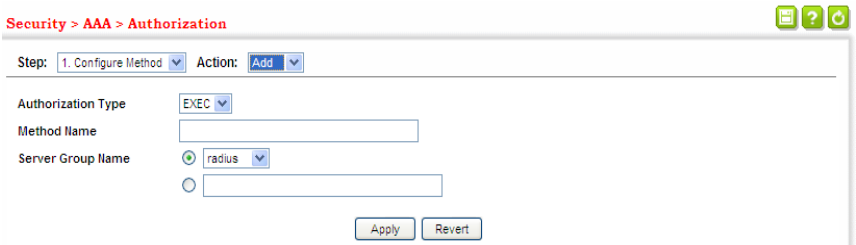
- **Interface** - Displays the console or Telnet interface to which these rules apply. (This field is null if the authorization method and associated server group has not been assigned to an interface.)

Web Interface

To configure the authorization method applied to the Exec service type and the assigned server group:

1. Click SECURITY > AAA > AUTHORIZATION .
2. Select CONFIGURE METHOD from the Step list.
3. Specify the name of the authorization method and server group name.
4. Click APPLY.

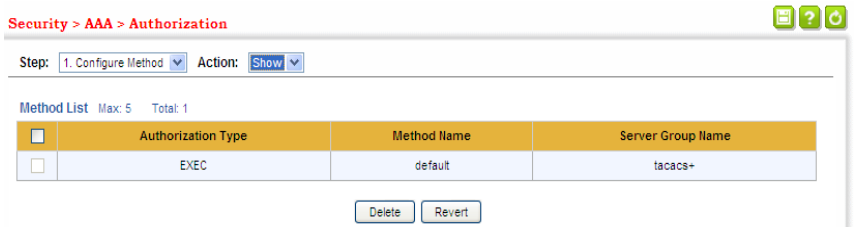
Figure 14-14. Configuring AAA Authorization Methods



To show the authorization method applied to the EXEC service type and the assigned server group:

1. Click SECURITY > AAA > AUTHORIZATION .
2. Select CONFIGURE METHOD from the Step list.
3. Select SHOW from the Action list.

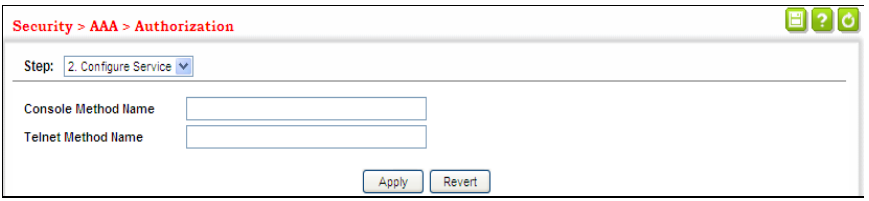
Figure 14-15. Showing AAA Authorization Methods



To configure the authorization method applied to local console, Telnet, or SSH connections:

1. Click SECURITY > AAA > AUTHORIZATION .
2. Select CONFIGURE SERVICE from the Step list.
3. Enter the required authorization method.
4. Click APPLY.

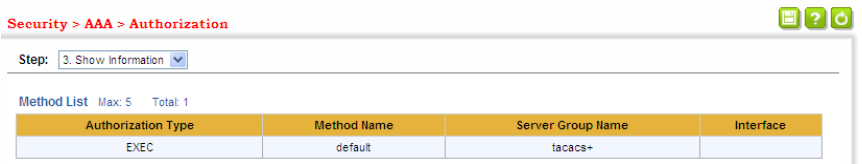
Figure 14-16. Configuring AAA Authorization Methods for Exec



To display a the configured authorization method and assigned server groups for The Exec service type:

1. Click SECURITY > AAA > AUTHORIZATION .
2. Select SHOW INFORMATION from the Step list.

Figure 14-17. Displaying the Applied AAA Authorization Method



14-2 Configuring User Accounts

Use the SECURITY > USER ACCOUNTS page to control management access to the switch based on manually configured user names and passwords.

CLI References

See Section 24-1: "User Accounts" on page 24-2 for CLI reference information.

Command Usage

- The default guest name is “guest” with the password “guest.” The default administrator name is “admin” with the password “admin.”
- The guest only has read access for most configuration parameters. However, the administrator has write access for all parameters governing the onboard agent. You should therefore assign a new administrator password as soon as possible, and store it in a safe place.

Parameters

These parameters are displayed in the web interface:

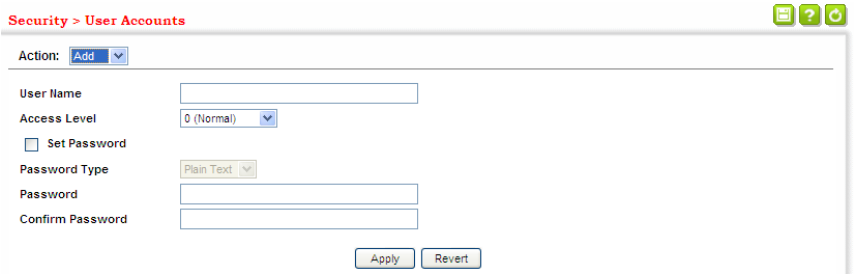
- **User Name** – The name of the user. (Maximum length: 8 characters; maximum number of users: 16)
- **Access Level** – Specifies the user level. (Options: 0 - Normal, 15 - Privileged)
- Normal privilege level provides access to a limited number of the commands which display the current status of the switch, as well as several database clear and reset functions. Privileged level provides full access to all commands.
- **Password Type** – Plain Text or Encrypted password.
- The encrypted password is required for compatibility with legacy password settings (i.e., plain text or encrypted) when reading the configuration file during system bootup or when downloading the configuration file from a TFTP or FTP server. There is no need for you to manually configure encrypted passwords.
- **Password** – Specifies the user password.(Range: 0-8 characters plain text, 32 encrypted, case sensitive)
- **Confirm Password** – Re-type the string entered in the previous field to ensure no errors were made. The switch will not change the password if these two fields do not match.

Web Interface

To configure user accounts:

1. Click SECURITY > USER ACCOUNTS.
2. Select ADD from the Action list.
3. Specify a user name, select the user's access level, then enter a password if required and confirm it.
4. Click APPLY.

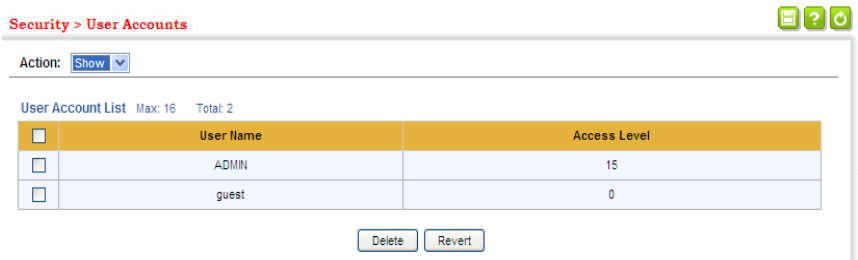
Figure 14-18. Configuring User Accounts



To show user accounts:

1. Click SECURITY > USER ACCOUNTS.
2. Select SHOW from the Action list.

Figure 14-19. Showing User Accounts



14-3 Web Authentication

Web authentication allows stations to authenticate and access the network in situations where 802.1X or Network Access authentication are infeasible or impractical. The web authentication feature allows unauthenticated hosts to request and receive a DHCP assigned IP address and perform DNS queries. All other traffic, except for HTTP protocol traffic, is blocked. The switch intercepts HTTP protocol traffic and redirects it to a switch-generated web page that facilitates user name and password authentication via RADIUS. Once authentication is successful, the web browser is forwarded on to the originally requested web page. Successful authentication is valid for all hosts connected to the port.

NOTE: RADIUS authentication must be activated and configured properly for the web authentication feature to work properly. (See "Configuring Local/ Remote Logon Authentication" on page 14-3.)

NOTE: Web authentication cannot be configured on trunk ports.

Configuring Global Settings for Web Authentication

Use the SECURITY > WEB AUTHENTICATION (CONFIGURE GLOBAL) page to edit the global parameters for web authentication.

CLI References

See Section 25-3: "Web Authentication" on page 25-20 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Web Authentication Status** – Enables web authentication for the switch. (Default: Disabled)

  Note that this feature must also be enabled for any port where required under the Configure Interface menu.

- **Session Timeout** – Configures how long an authenticated session stays active before it must re-authenticate itself. (Range: 300-3600 seconds, or 0 for disabled; Default: 3600 seconds)

- **Quiet Period** – Configures how long a host must wait to attempt authentication again after it has exceeded the maximum allowable failed login attempts. (Range: 1-180 seconds; Default: 60 seconds)

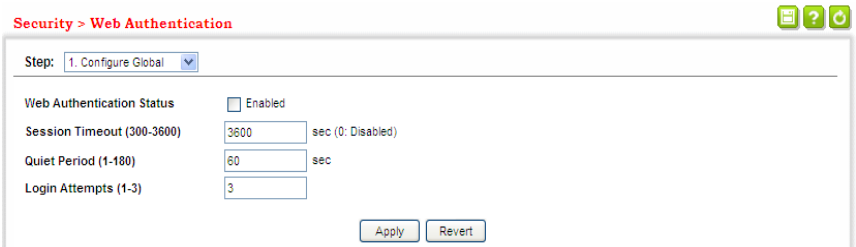
- **Login Attempts** – Configures the amount of times a supplicant may attempt and fail authentication before it must wait the configured quiet period. (Range: 1-3 attempts; Default: 3 attempts)

Web Interface

To configure global parameters for web authentication:

1. Click SECURITY > WEB AUTHENTICATION
2. Select CONFIGURE GLOBAL from the Step list.
3. Enable web authentication globally on the switch, and adjust any of the protocol parameters as required.
4. Click APPLY.

Figure 14-20. Configuring Global Settings for Web Authentication



Configuring Interface Settings for Web Authentication

Use the SECURITY > WEB AUTHENTICATION (CONFIGURE INTERFACE) page to enable web authentication on a port, and display information for any connected hosts.

CLI References

See Section 25-3: "Web Authentication" on page 25-20 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

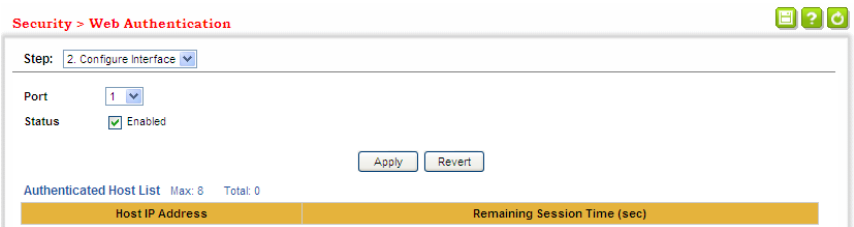
- **Port** – Indicates the port being configured.
- **Status** – Configures the web authentication status for the port.
- **Host IP Address** – Indicates the IP address of each connected host.
- **Remaining Session Time** – Indicates the remaining time until the current authorization session for the host expires.
- **Apply** – Enables web authentication if the Status box is checked.
- **Re-authenticate** – Ends all authenticated web sessions for selected host IP addresses in the Authenticated Host List, and forces the users to re-authenticate.
- **Revert** – Restores the previous configuration settings.

Web Interface

To enable web authentication for a port:

1. Click SECURITY > WEB AUTHENTICATION.
2. Select CONFIGURE INTERFACE from the Step list.
3. Set the status box to enabled for any port that requires web authentication, and click APPLY
4. Mark the check box for any host addresses that need to be re-authenticated, and click RE-AUTHENTICATE.

Figure 14-21. Configuring Interface Settings for Web Authentication



14-4 Network Access (MAC Address Authentication)

Some devices connected to switch ports may not be able to support 802.1X authentication due to hardware or software limitations. This is often true for devices such as network printers, IP phones, and some wireless access points. The switch enables network access from these devices to be controlled by authenticating device MAC addresses with a central RADIUS server.

NOTE: RADIUS authentication must be activated and configured properly for the MAC Address authentication feature to work properly. (See "Configuring Remote Logon Authentication Servers" on page 14-4.)

NOTE: MAC authentication cannot be configured on trunk ports.

CLI References

See Section 25-2: "Network Access (MAC Address Authentication)" on page 25-4for CLI reference information.

Command Usage

- MAC address authentication controls access to the network by authenticating the MAC address of each host that attempts to connect to a switch port. Traffic received from a specific MAC address is forwarded by the switch only if the source MAC address is successfully authenticated by a central RADIUS server. While authentication for a MAC address is in progress, all traffic is blocked until authentication is completed. On successful authentication, the RADIUS server may optionally assign VLAN and quality of service settings for the switch port.
- When enabled on a port, the authentication process sends a Password Authentication Protocol (PAP) request to a configured RADIUS server. The user name and password are both equal to the MAC address being authenticated. On the RADIUS server, PAP user name and passwords must be configured in the MAC address format XX-XX-XX-XX-XX-XX (all in upper case).
- Authenticated MAC addresses are stored as dynamic entries in the switch secure MAC address table and are removed when the aging time expires. The maximum number of secure MAC addresses supported for the switch system is 1024.
- Configured static MAC addresses are added to the secure address table when seen on a switch port. Static addresses are treated as authenticated without sending a request to a RADIUS server.

- When port status changes to down, all MAC addresses mapped to that port are cleared from the secure MAC address table. Static VLAN assignments are not restored.
- The RADIUS server may optionally return a VLAN identifier list to be applied to the switch port. The following attributes need to be configured on the RADIUS server.
  - **Tunnel-Type** = VLAN
  - **Tunnel-Medium-Type** = 802
  - **Tunnel-Private-Group-ID** = 1u,2t [*VLAN ID list*]

  The VLAN identifier list is carried in the RADIUS "Tunnel-Private-Group-ID" attribute. The VLAN list can contain multiple VLAN identifiers in the format "1u,2t,3u" where "u" indicates an untagged VLAN and "t" a tagged VLAN.
- The RADIUS server may optionally return dynamic QoS assignments to be applied to a switch port for an authenticated user. The "Filter-ID" attribute (attribute 11) can be configured on the RADIUS server to pass the following QoS information:

Table 14-1. Dynamic QoS Profiles

Profile	Attribute Syntax	Example
DiffServ	**service-policy-in**=*policy-map-name*	service-policy-in=p1
Rate Limit	**rate-limit-input**=*rate*	rate-limit-input=100 (in units of Kbps)
802.1p	**switchport-priority-default**=*value*	switchport-priority-default=2
IP ACL	**ip-access-group-in**=*ip-acl-name*	ip-access-group-in=ipv4acl
IPv6 ACL	**ipv6-access-group-in**=*ipv6-acl-name*	ipv6-access-group-in=ipv6acl
MAC ACL	**mac-access-group-in**=*mac-acl-name*	mac-access-group-in=macAcl

- Multiple profiles can be specified in the Filter-ID attribute by using a semicolon to separate each profile.

  For example, the attribute "service-policy-in=pp1;rate-limit-input=100" specifies that the diffserv profile name is "pp1," and the ingress rate limit profile value is 100 kbps.
- If duplicate profiles are passed in the Filter-ID attribute, then only the first profile is used.

  For example, if the attribute is "service-policy-in=p1;service-policy-in=p2", then the switch applies only the DiffServ profile "p1."
- Any unsupported profiles in the Filter-ID attribute are ignored.

  For example, if the attribute is "map-ip-dscp=2:3;service-policy-in=p1," then the switch ignores the "map-ip-dscp" profile.
- When authentication is successful, the dynamic QoS information may not be passed from the RADIUS server due to one of the following conditions (authentication result remains unchanged):
  - The Filter-ID attribute cannot be found to carry the user profile.

  - The Filter-ID attribute is empty.
  - The Filter-ID attribute format for dynamic QoS assignment is unrecognizable (can not recognize the whole Filter-ID attribute).
- Dynamic QoS assignment fails and the authentication result changes from success to failure when the following conditions occur:
  - Illegal characters found in a profile value (for example, a non-digital character in an 802.1p profile value).
  - Failure to configure the received profiles on the authenticated port.
- When the last user logs off on a port with a dynamic QoS assignment, the switch restores the original QoS configuration for the port.
- When a user attempts to log into the network with a returned dynamic QoS profile that is different from users already logged on to the same port, the user is denied access.
- While a port has an assigned dynamic QoS profile, any manual QoS configuration changes only take effect after all users have logged off the port.

Configuring Global Settings for Network Access

MAC address authentication is configured on a per-port basis, however there are two configurable parameters that apply globally to all ports on the switch. Use the SECURITY > NETWORK ACCESS (CONFIGURE GLOBAL) page to configure MAC address authentication aging and reauthentication time.

CLI References

See Section 25-2: "Network Access (MAC Address Authentication)" on page 25-4 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Aging Status** – Enables aging for authenticated MAC addresses stored in the secure MAC address table. (Default: Disabled)

  This parameter applies to authenticated MAC addresses configured by the MAC Address Authentication process described in this section, as well as to any secure MAC addresses authenticated by 802.1X, regardless of the 802.1X Operation Mode (Single-Host, Multi-Host, or MAC-Based authentication as described on page 14-75).

  Authenticated MAC addresses are stored as dynamic entries in the switch's secure MAC address table and are removed when the aging time expires.

  The maximum number of secure MAC addresses supported for the switch system is 1024.

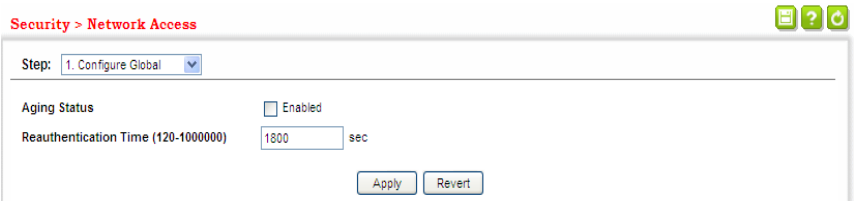
- **Reauthentication Time** – Sets the time period after which a connected host must be reauthenticated. When the reauthentication time expires for a secure MAC address, it is reauthenticated with the RADIUS server. During the reauthentication process traffic through the port remains unaffected. (Range: 120-1000000 seconds; Default: 1800 seconds)

Web Interface

To configure aging status and reauthentication time for MAC address authentication:

1. Click SECURITY > NETWORK ACCESS.
2. Select CONFIGURE GLOBAL from the Step list.
3. Enable or disable aging for secure addresses, and modify the reauthentication time as required.
4. Click APPLY.

Figure 14-22. Configuring Global Settings for Network Access



Configuring Network Access for Ports

Use the SECURITY > NETWORK ACCESS (CONFIGURE INTERFACE - GENERAL) page to configure MAC authentication on switch ports, including enabling address authentication, setting the maximum MAC count, and enabling dynamic VLAN or dynamic QoS assignments.

CLI References

See Section 25-2: "Network Access (MAC Address Authentication)" on page 25-4 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- MAC Authentication
  - **Status** – Enables MAC authentication on a port. (Default: Disabled)
  - **Intrusion** – Sets the port response to a host MAC authentication failure to either block access to the port or to pass traffic through. (Options: Block, Pass; Default: Block)

- **Max MAC Count**[1] – Sets the maximum number of MAC addresses that can be authenticated on a port via MAC authentication; that is, the Network Access process described in this section. (Range: 1-1024; Default: 1024)

- **Network Access Max MAC Count**[5] – Sets the maximum number of MAC addresses that can be authenticated on a port interface via all forms of authentication (including Network Access and IEEE 802.1X). (Range: 1-1024; Default: 1024)

- **Guest VLAN** – Specifies the VLAN to be assigned to the port when 802.1X Authentication fails. (Range: 0-4093, where 0 means disabled; Default: Disabled)

  The VLAN must already be created and active (see "Configuring VLAN Groups" on page 7-4). Also, when used with 802.1X authentication, intrusion action must be set for "Guest VLAN" (see "Configuring Port Authenticator Settings for 802.1X").

- **Dynamic VLAN** – Enables dynamic VLAN assignment for an authenticated port. When enabled, any VLAN identifiers returned by the RADIUS server through the 802.1X authentication process are applied to the port, providing the VLANs have already been created on the switch. (GVRP is not used to create the VLANs.) (Default: Enabled)

  The VLAN settings specified by the first authenticated MAC address are implemented for a port. Other authenticated MAC addresses on the port must have the same VLAN configuration, or they are treated as authentication failures.

  If dynamic VLAN assignment is enabled on a port and the RADIUS server returns no VLAN configuration (to the 802.1X authentication process), the authentication is still treated as a success, and the host is assigned to the default untagged VLAN.

  When the dynamic VLAN assignment status is changed on a port, all authenticated addresses mapped to that port are cleared from the secure MAC address table.

- **Dynamic QoS** – Enables dynamic QoS assignment for an authenticated port. (Default: Disabled)

- **MAC Filter ID** – Allows a MAC Filter to be assigned to the port. MAC addresses or MAC address ranges present in a selected MAC Filter are exempt from authentication on the specified port (as described under "Configuring a MAC Address Filter"). (Range: 1-64; Default: None)

Web Interface

To configure MAC authentication on switch ports:

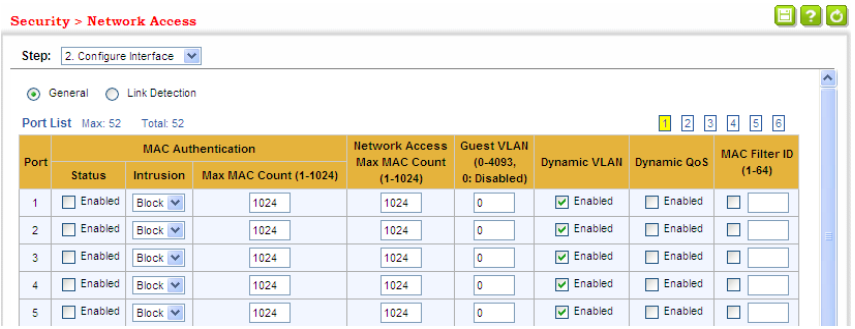
1. Click SECURITY > NETWORK ACCESS.
2. Select CONFIGURE INTERFACE from the Step list.

---

1. The maximum number of MAC addresses per port is 1024, and the maximum number of secure MAC addresses supported for the switch system is 1024. When the limit is reached, all new MAC addresses are treated as authentication failures.

3. Click the GENERAL button.
4. Make any configuration changes required to enable address authentication on a port, set the maximum number of secure addresses supported, the guest VLAN to use when MAC Authentication or 802.1X Authentication fails, and the dynamic VLAN and QoS assignments.
5. Click APPLY.

Figure 14-23. Configuring Interface Settings for Network Access


Security > Network Access
Step: 2. Configure Interface
General
Link Detection
Port List Max: 52 Total: 52
1 2 3 4 5 6
Port
MAC Authentication
Status
Intrusion
Max MAC Count (1-1024)
Network Access Max MAC Count (1-1024)
Guest VLAN (0-4093, 0: Disabled)
Dynamic VLAN
Dynamic QoS
MAC Filter ID (1-64)
1 Enabled Block 1024 1024 0 Enabled Enabled
2 Enabled Block 1024 1024 0 Enabled Enabled
3 Enabled Block 1024 1024 0 Enabled Enabled
4 Enabled Block 1024 1024 0 Enabled Enabled
5 Enabled Block 1024 1024 0 Enabled Enabled

Configuring Port Link Detection

Use the SECURITY > NETWORK ACCESS (CONFIGURE INTERFACE - LINK DETECTION) page to send an SNMP trap and/or shut down a port when a link event occurs.

CLI References

See Section 25-2: "Network Access (MAC Address Authentication)" on page 25-4 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Link Detection Status** – Configures whether Link Detection is enabled or disabled for a port.
- **Condition** – The link event type which will trigger the port action.
  - **Link up** – Only link up events will trigger the port action.
  - **Link down** – Only link down events will trigger the port action.
  - **Link up and down** – All link up and link down events will trigger the port action.
- **Action** – The switch can respond in three ways to a link up or down trigger event.
  - **Trap** – An SNMP trap is sent.

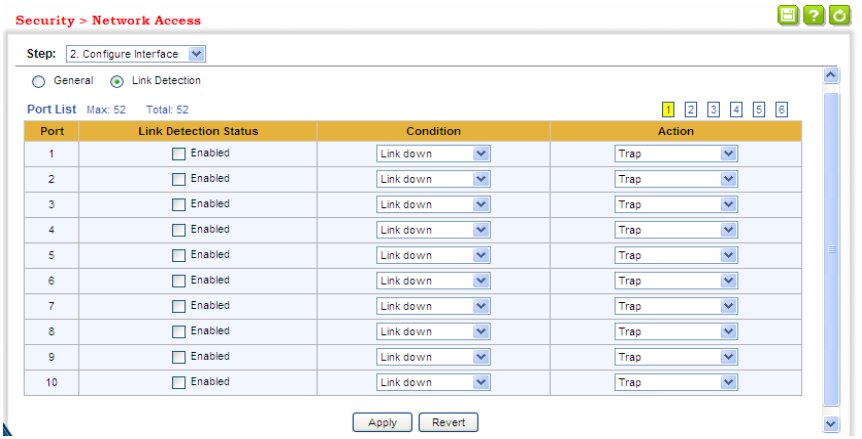
- **Trap and shutdown** – An SNMP trap is sent and the port is shut down.
- **Shutdown** – The port is shut down.

Web Interface

To configure link detection on switch ports:

1. Click SECURITY > NETWORK ACCESS.
2. Select CONFIGURE INTERFACE from the Step list.
3. Click the LINK DETECTION button.
4. Modify the link detection status, trigger condition, and the response for any port.
5. Click APPLY.

Figure 14-24. Configuring Link Detection for Network Access



Configuring a MAC Address Filter

Use the SECURITY > NETWORK ACCESS (CONFIGURE MAC FILTER) page to designate specific MAC addresses or MAC address ranges as exempt from authentication. MAC addresses present in MAC Filter tables activated on a port are treated as pre-authenticated on that port.

CLI References

See Section 25-2: "Network Access (MAC Address Authentication)" on page 25-4 for CLI reference information.

Command Usage

- Specified MAC addresses are exempt from authentication.
- Up to 65 filter tables can be defined.
- There is no limitation on the number of entries used in a filter table.

Parameters

These parameters are displayed in the web interface:

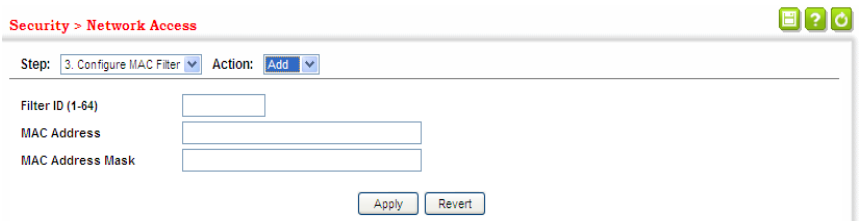
- **Filter ID** – Adds a filter rule for the specified filter.
- **MAC Address** – The filter rule will check ingress packets against the entered MAC address or range of MAC addresses (as defined by the MAC Address Mask).
- **MAC Address Mask** – The filter rule will check for the range of MAC addresses defined by the MAC bit mask. If you omit the mask, the system will assign the default mask of an exact match. (Range: 000000000000 - FFFFFFFFFFFF; Default: FFFFFFFFFFFF)

Web Interface

To add a MAC address filter for MAC authentication:

1. Click SECURITY > NETWORK ACCESS.
2. Select CONFIGURE MAC FILTER from the Step list.
3. Select ADD from the Action list.
4. Enter a FILTER ID, MAC ADDRESS, and optional MAC ADDRESS MASK.
5. Click APPLY.

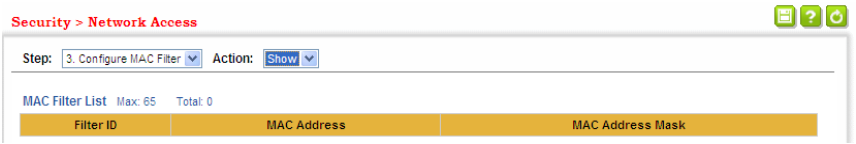
Figure 14-25. Configuring a MAC Address Filter for Network Access



To show the MAC Address Filter table for MAC authentication:

1. Click SECURITY > NETWORK ACCESS.
2. Select CONFIGURE MAC FILTER from the Step list.
3. Select SHOW from the Action list.

Figure 14-26. Showing the MAC Address Filter Table for Network Access



Displaying Secure MAC Address Information

Use the SECURITY > NETWORK ACCESS (SHOW INFORMATION) page to display the authenticated MAC addresses stored in the secure MAC address table. Information on the secure MAC entries can be displayed and selected entries can be removed from the table.

CLI References

See Section 25-2: "Network Access (MAC Address Authentication)" on page 25-4 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

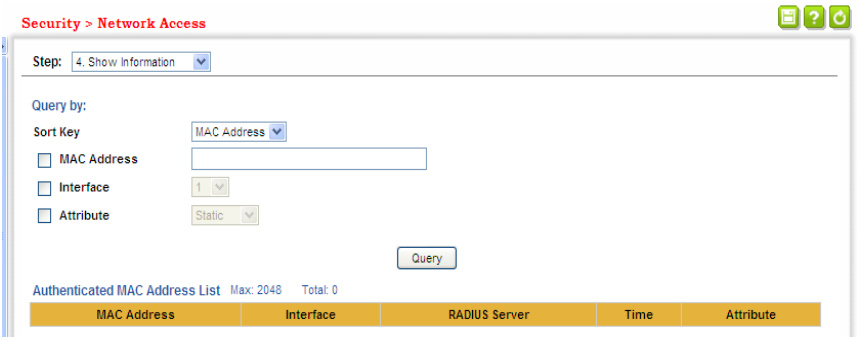
- **Query By** – Specifies parameters to use in the MAC address query.
  - **Sort Key** – Sorts the information displayed based on MAC address, port interface, or attribute.
  - **MAC Address** – Specifies a specific MAC address.
  - **Interface** – Specifies a port interface.
  - **Attribute** – Displays static or dynamic addresses.
- Authenticated MAC Address List
  - **MAC Address** – The authenticated MAC address.
  - **Interface** – The port interface associated with a secure MAC address.
  - **RADIUS Server** – The IP address of the RADIUS server that authenticated the MAC address.
  - **Time** – The time when the MAC address was last authenticated.
  - **Attribute** – Indicates a static or dynamic address.

Web Interface

To display the authenticated MAC addresses stored in the secure MAC address table:

1. Click SECURITY > NETWORK ACCESS.
2. Select SHOW INFORMATION from the Step list.
3. Use the sort key to display addresses based MAC ADDRESS, INTERFACE, OR ATTRIBUTE.
4. Restrict the displayed addresses by entering a specific address in the MAC ADDRESS field, specifying a port in the Interface field, or setting the address type to static or dynamic in the ATTRIBUTE field.
5. Click QUERY.

Figure 14-27. Showing Addresses Authenticated for Network Access



14-5 Configuring HTTPS

You can configure the switch to enable the Secure Hypertext Transfer Protocol (HTTPS) over the Secure Socket Layer (SSL), providing secure access (i.e., an encrypted connection) to the switch's web interface.

Configuring Global Settings for HTTPS

Use the SECURITY > HTTPS (CONFIGURE GLOBAL) page to enable or disable HTTPS and specify the UDP port used for this service.

CLI References

See Section 24-6: "Web Server" on page 24-27 for CLI reference information.

Command Usage

- HTTP and HTTPS are implemented as mutually exclusive services on the switch. (HTTP can only be configured through the CLI using the ip http server command described on page 24-28.)
- If you enable HTTPS, you must indicate this in the URL that you specify in your browser: https*://device[:port_number]*
- When you start HTTPS, the connection is established in this way:
  - The client authenticates the server using the server's digital certificate.
  - The client and server negotiate a set of security protocols to use for the connection.
  - The client and server generate session keys for encrypting and decrypting data.
- The client and server establish a secure encrypted connection.

  A padlock icon should appear in the status bar for Internet Explorer 5.x or above, Netscape 6.2 or above, and Mozilla Firefox 2.0.0.0 or above.
- The following web browsers and operating systems currently support HTTPS:

Table 14-2. HTTPS System Support

Web Browser	Operating System
Internet Explorer 5.0 or later	Windows 98,Windows NT (with service pack 6a), Windows 2000, Windows XP, Windows Vista, Windows 7
Netscape 6.2 or later	Windows 98,Windows NT (with service pack 6a), Windows 2000, Windows XP, Solaris 2.6
Mozilla Firefox 2.0.0.0 or later	Windows 2000, Windows XP, Linux

- To specify a secure-site certificate, see "Replacing the Default Secure-site Certificate" on page 14-33.

NOTE: Users are automatically logged off of the HTTP server or HTTPS server if no input is detected for 600 seconds.

NOTE: Connection to the web interface is not supported for HTTPS using an IPv6 link local address.

Parameters

These parameters are displayed in the web interface:

- **HTTPS Status** – Allows you to enable/disable the HTTPS server feature on the switch. (Default: Disabled)

- **HTTPS Port** – Specifies the UDP port number used for HTTPS connection to the switch's web interface. (Default: Port 443)

Web Interface

To configure HTTPS:

1. Click SECURITY > HTTPS.
2. Select CONFIGURE GLOBAL from the Step list.
3. Enable HTTPS and specify the port number if required.
4. Click APPLY.

Figure 14-28. Configuring HTTPS

Replacing the Default Secure-site Certificate

Use the SECURITY > HTTPS (COPY CERTIFICATE) page to replace the default secure-site certificate.

When you log onto the web interface using HTTPS (for secure access), a Secure Sockets Layer (SSL) certificate appears for the switch. By default, the certificate that Netscape and Internet Explorer display will be associated with a warning that the site is not recognized as a secure site. This is because the certificate has not been signed by an approved certification authority. If you want this warning to be replaced by a message confirming that the connection to the switch is secure, you must obtain a unique certificate and a private key and password from a recognized certification authority.

WARNING: For maximum security, we recommend you obtain a unique Secure Sockets Layer certificate at the earliest opportunity. This is because the default certificate for the switch is not unique to the hardware you have purchased.

When you have obtained these, place them on your TFTP server and transfer them to the switch to replace the default (unrecognized) certificate with an authorized one.

NOTE: The switch must be reset for the new certificate to be activated. To reset the switch, see Section 5-11: "Resetting the System" on page 5-24 or type "reload" at the command prompt: SSE-G2252#reload

CLI References

See Section 24-6: "Web Server" on page 24-27 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

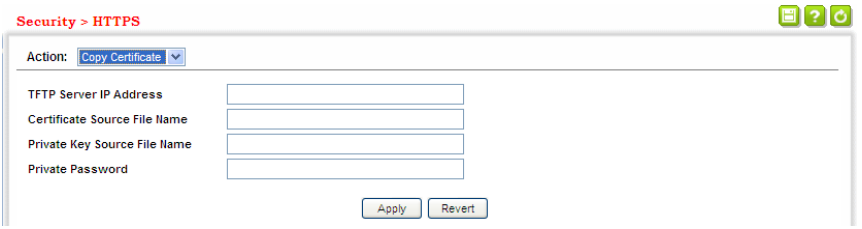
- **TFTP Server IP Address** – IP address of TFTP server which contains the certificate file.
- **Certificate Source File Name** – Name of certificate file stored on the TFTP server.
- **Private Key Source File Name** – Name of private key file stored on the TFTP server.
- **Private Password** – Password stored in the private key file. This password is used to verify authorization for certificate use, and is verified when downloading the certificate to the switch.

Web Interface

To replace the default secure-site certificate:

1. Click SECURITY > HTTPS.
2. Select COPY CERTIFICATE from the Step list.
3. Fill in the TFTP SERVER IP ADDRESS, CERTIFICATE and PRIVATE KEY file names, and PRIVATE PASSWORD.
4. Click APPLY.

Figure 14-29. Downloading the Secure-Site Certificate



14-6 Configuring the Secure Shell

The Berkeley-standard includes remote access tools originally designed for Unix systems. Some of these tools have also been implemented for Microsoft Windows and other environments. These tools, including commands such as *rlogin* (remote login), *rsh* (remote shell), and *rcp* (remote copy), are not secure from hostile attacks.

The Secure Shell (SSH) includes server/client applications intended as a secure replacement for the older Berkeley remote access tools. SSH can also provide remote management access to this switch as a secure replacement for Telnet. When the client contacts the switch via the SSH protocol, the switch generates a public-key that the client uses along with a local user name and password for access authentication. SSH also encrypts all data transfers passing between the switch and SSH-enabled management station clients, and ensures that data traveling over the network arrives unaltered.

NOTE: You need to install an SSH client on the management station to access the switch for management via the SSH protocol.

NOTE: The switch supports both SSH Version 1.5 and 2.0 clients.

Command Usage

The SSH server on this switch supports both password and public key authentication. If password authentication is specified by the SSH client, then the password can be authenticated either locally or via a RADIUS or TACACS+ remote authentication server, as specified in "Configuring Local/Remote Logon Authentication" on page 14-3. If public key authentication is specified by the client, then you must configure authentication keys on both the client and the switch as described in the following section. Note that regardless of whether you use public key or password authentication, you still have to generate authentication keys on the switch (SSH Host Key Settings) and enable the SSH server (Authentication Settings).

To use the SSH server, complete these steps:

1. **Generate a Host Key Pair** – On the SSH Host Key Settings page, create a host public/private key pair.
2. **Provide Host Public Key to Clients** – Many SSH client programs automatically import the host public key during the initial connection setup with the switch. Otherwise, you need to manually create a known hosts file on the management station and place the host public key in it. An entry for a public key in the known hosts file would appear similar to the following example:

   ```
   10.1.0.54 1024 35
   156849954018676692593339467750546173253136748908365472 54
   150202455931998685443583616519999233297817660658309 56
   10825913212890233 765468017262725714134287629413011961955667 82
   595664104869574278881462065194174677298486546861571773939016477935594 2
   303577413098022737087794545240839717526463580581767167095748047761 17
   ```

3. **Import Client's Public Key to the Switch** – See "Importing User Public Keys" on page 14-40, or use the copy tftp public-key command (page 21-15) to copy a file containing the public key for all the SSH client's granted management access to the switch. (Note that these clients must be configured locally on the switch via the User

Accounts page as described on Section 14-2: "Configuring User Accounts" on page 14-17.) The clients are subsequently authenticated using these keys. The current firmware only accepts public key files based on standard UNIX format as shown in the following example for an RSA Version 1 key:

```
1024 35
134108168560989392104094492015542534763164192187295892114317388005553616
161631051775940838686311092912322268285192543746031009371877211996963178
781366277414168985132049117204830339254324101637997592371449011938006090
902539484084827178194372288402533115952134861022902978982721353267131629
294325328189150453063939166 43 steve@192.168.1.19
```

4. **Set the Optional Parameters** – On the SSH SETTINGS page, configure the optional parameters, including the authentication timeout, the number of retries, and the server key size.

5. **Enable SSH Service** – On the SSH SETTINGS page, enable the SSH server on the switch.

6. **Authentication** – One of the following authentication methods is employed:

Password Authentication (for SSH v1.5 or V2 Clients)

a. The client sends its password to the server.

b. The switch compares the client's password to those stored in memory.

c. If a match is found, the connection is allowed.

NOTE: To use SSH with only password authentication, the host public key must still be given to the client, either during initial connection or manually entered into the known host file. However, you do not need to configure the client's keys.

Public Key Authentication – When an SSH client attempts to contact the switch, the SSH server uses the host key pair to negotiate a session key and encryption method. Only clients that have a private key corresponding to the public keys stored on the switch can access it. The following exchanges take place during this process:

Authenticating SSH v1.5 Clients

a. The client sends its RSA public key to the switch.

b. The switch compares the client's public key to those stored in memory.

c. If a match is found, the switch uses its secret key to generate a random 256-bit string as a challenge, encrypts this string with the user's public key, and sends it to the client.

d. The client uses its private key to decrypt the challenge string, computes the MD5 checksum, and sends the checksum back to the switch.

e. The switch compares the checksum sent from the client against that computed for the original string it sent. If the two checksums match, this means that the client's private key corresponds to an authorized public key, and the client is authenticated.

Authenticating SSH v2 Clients

a. The client first queries the switch to determine if DSA public key authentication using a preferred algorithm is acceptable.

b. If the specified algorithm is supported by the switch, it notifies the client to proceed with the authentication process. Otherwise, it rejects the request.

c. The client sends a signature generated using the private key to the switch.

d. When the server receives this message, it checks whether the supplied key is acceptable for authentication, and if so, it then checks whether the signature is correct. If both checks succeed, the client is authenticated.

NOTE: The SSH server supports up to four client sessions. The maximum number of client sessions includes both current Telnet sessions and SSH sessions.

Configuring the SSH Server

Use the SECURITY > SSH (CONFIGURE GLOBAL) page to enable the SSH server and configure basic settings for authentication.

NOTE: A host key pair must be configured on the switch before you can enable the SSH server. See "Generating the Host Key Pair" on page 14-38.

CLI References

See Section 24-8: "Secure Shell" on page 24-34 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **SSH Server Status** – Allows you to enable/disable the SSH server on the switch. (Default: Disabled)
- **Version** – The Secure Shell version number. Version 2.0 is displayed, but the switch supports management access via either SSH Version 1.5 or 2.0 clients.
- **Authentication Timeout** – Specifies the time interval in seconds that the SSH server waits for a response from a client during an authentication attempt. (Range: 1-120 seconds; Default: 120 seconds)
- **Authentication Retries** – Specifies the number of authentication attempts that a client is allowed before authentication fails and the client has to restart the authentication process. (Range: 1-5 times; Default: 3)
- **Server-Key Size** – Specifies the SSH server key size. (Range: 512-896 bits; Default:768)

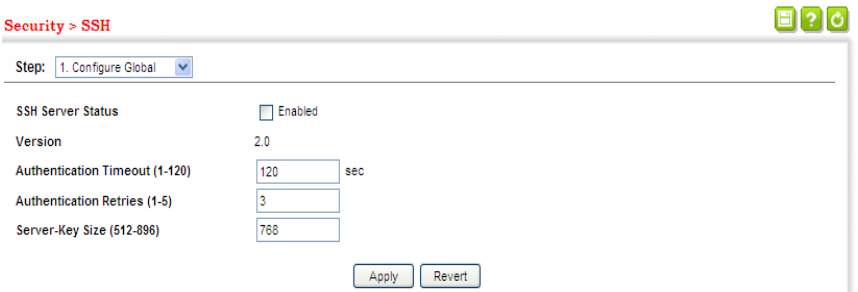
- The server key is a private key that is never shared outside the switch.
- The host key is shared with the SSH client, and is fixed at 1024 bits.

Web Interface

To configure the SSH server:

1. Click SECURITY > SSH.
2. Select CONFIGURE GLOBAL from the Step list.
3. Enable the SSH server.
4. Adjust the authentication parameters as required.
5. Click APPLY.

Figure 14-30. Configuring the SSH Server



Generating the Host Key Pair

Use the SECURITY > SSH (CONFIGURE HOST KEY - GENERATE) page to generate a host public/private key pair used to provide secure communications between an SSH client and the switch. After generating this key pair, you must provide the host public key to SSH clients and import the client's public key to the switch as described in the section "Importing User Public Keys" on page 14-40.

NOTE: A host key pair must be configured on the switch before you can enable the SSH server. See "Configuring the SSH Server" on page 14-37.

CLI References

See Section 24-8: "Secure Shell" on page 24-34 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Host-Key Type** – The key type used to generate the host key pair (i.e., public and private keys). (Range: RSA (Version 1), DSA (Version 2), Both; Default: Both)

  The SSH server uses RSA or DSA for key exchange when the client first establishes a connection with the switch, and then negotiates with the client to select either DES (56-bit) or 3DES (168-bit) for data encryption.

NOTE: The switch uses only RSA Version 1 for SSHv1.5 clients and DSA Version 2 for SSHv2 clients.

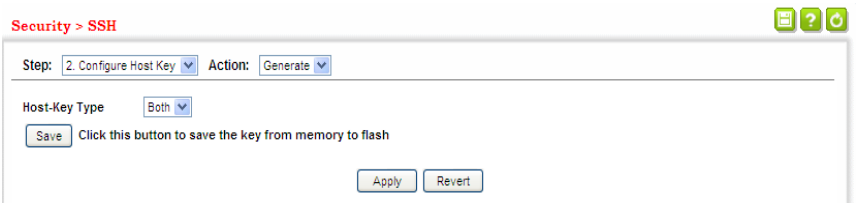
- **Save Host-Key from Memory to Flash** – Saves the host key from RAM (i.e., volatile memory) to flash memory. Otherwise, the host key pair is stored to RAM by default. Note that you must select this item prior to generating the host-key pair. (Default: Disabled)

Web Interface

To generate the SSH host key pair:

1. Click SECURITY > SSH.
2. Select CONFIGURE HOST KEY from the Step list.
3. Select GENERATE from the Action list.
4. Select the host-key type from the drop-down box.
5. Select the option to save the host key from memory to flash if required.
6. Click APPLY.

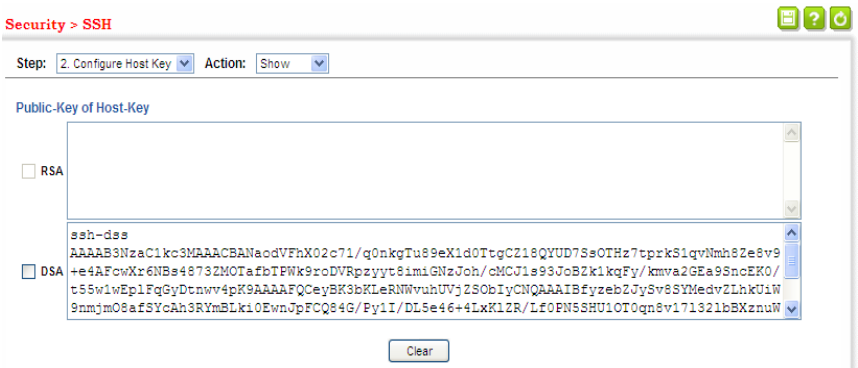
Figure 14-31. Generating the SSH Host Key Pair



To display or clear the SSH host key pair:

1. Click SECURITY > SSH.
2. Select CONFIGURE HOST KEY from the Step list.
3. Select SHOW from the Action list.
4. Select the host-key type to clear.
5. Click CLEAR.

Figure 14-32. Showing the SSH Host Key Pair



Importing User Public Keys

Use the SECURITY > SSH (CONFIGURE USER KEY - COPY) page to upload a user's public key to the switch. This public key must be stored on the switch for the user to be able to log in using the public key authentication mechanism. If the user's public key does not exist on the switch, SSH will revert to the interactive password authentication mechanism to complete authentication.

CLI References

See Section 24-8: "Secure Shell" on page 24-34 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **User Name** – This drop-down box selects the user who's public key you wish to manage. Note that you must first create users on the User Accounts page (see Section 14-2: "Configuring User Accounts" on page 14-17).
- **User Key Type** – The type of public key to upload.
  - RSA: The switch accepts a RSA version 1 encrypted public key.
  - DSA: The switch accepts a DSA version 2 encrypted public key.

  The SSH server uses RSA or DSA for key exchange when the client first establishes a connection with the switch, and then negotiates with the client to select either DES (56-bit) or 3DES (168-bit) for data encryption.

  The switch uses only RSA Version 1 for SSHv1.5 clients and DSA Version 2 for SSHv2 clients.
- **TFTP Server IP Address** – The IP address of the TFTP server that contains the public key file you wish to import.

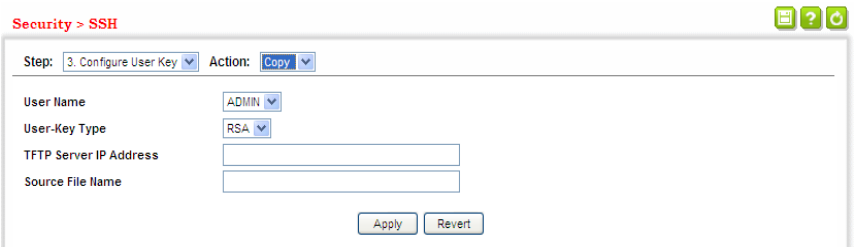
- **Source File Name** – The public key file to upload.

Web Interface

To copy the SSH user's public key:

1. Click SECURITY > SSH.
2. Select CONFIGURE USER KEY from the Step list.
3. Select COPY from the Action list.
4. Select the user name and the public-key type from the respective drop-down boxes, input the TFTP server IP address and the public key source file name.
5. Click APPLY.

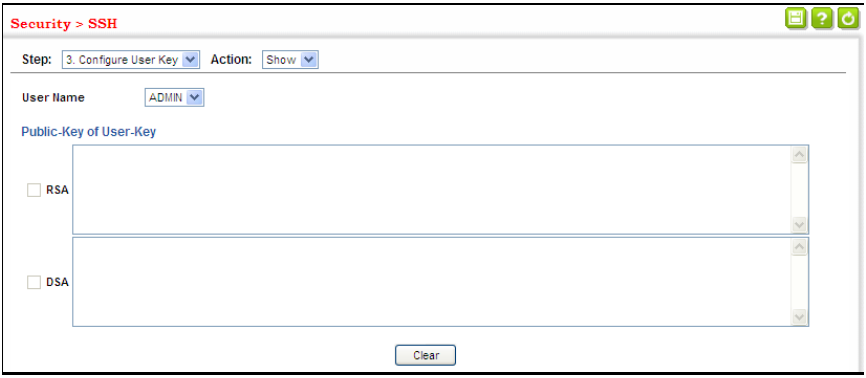
Figure 14-33. Copying the SSH User's Public Key



To display or clear the SSH user's public key:

1. Click SECURITY > SSH.
2. Select CONFIGURE USER KEY from the Step list.
3. Select SHOW from the Action list.
4. Select a user from the User Name list.
5. Select the host-key type to clear.
6. Click CLEAR.

Figure 14-34. Showing the SSH User's Public Key



14-7 Access Control Lists

Access Control Lists (ACL) provide packet filtering for IPv4 frames (based on address, protocol, Layer 4 protocol port number or TCP control code), IPv6 frames (based on address, DSCP traffic class, next header type, or any frames (based on MAC address or Ethernet type). To filter incoming packets, first create an access list, add the required rules, and then bind the list to a specific port.

Configuring Access Control Lists

An ACL is a sequential list of permit or deny conditions that apply to IP addresses, MAC addresses, or other more specific criteria. This switch tests ingress packets against the conditions in an ACL one by one. A packet will be accepted as soon as it matches a permit rule, or dropped as soon as it matches a deny rule. If no rules match, the packet is accepted.

Command Usage

The following restrictions apply to ACLs:

- The maximum number of ACLs is 64.
- The maximum number of rules per system is 512 rules.
- An ACL can have up to 32 rules. However, due to resource restrictions, the average number of rules bound to the ports should not exceed 20.

Showing TCAM Utilization

Use the SECURITY > ACL (CONFIGURE ACL - SHOW TCAM) page to show utilization parameters for TCAM (Ternary Content Addressable Memory), including the number policy control entries in use, the number of free entries, and the overall percentage of TCAM in use.

CLI References

See "show access-list tcam-utilization" on page 21-3 for CLI reference information.

Command Usage

Policy control entries (PCEs) are used by various system functions which rely on rule-based searches, including Access Control Lists (ACLs), IP Source Guard filter rules, Quality of Service (QoS) processes, or traps.

For example, when binding an ACL to a port, each rule in an ACL will use two PCEs; and when setting an IP Source Guard filter rule for a port, the system will also use two PCEs.

Parameters

These parameters are displayed in the web interface:

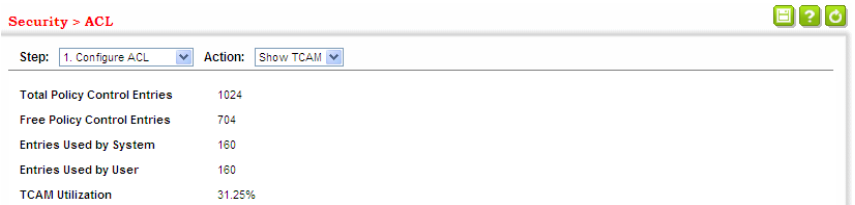
- **Total Policy Control Entries** – The number policy control entries in use.
- **Free Policy Control Entries** – The number of policy control entries available for use.
- **Entries Used by System** – The number of policy control entries used by the operating system.
- **Entries Used by User** – The number of policy control entries used by configuration settings, such as access control lists.
- **TCAM Utilization** – The overall percentage of TCAM in use.

Web Interface

To show information on TCAM utilization:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select SHOW TCAM from the Action list.

Figure 14-35. Showing TCAM Utilization


Security > ACL
Step: 1. Configure ACL
Action: Show TCAM
Total Policy Control Entries 1024
Free Policy Control Entries 704
Entries Used by System 160
Entries Used by User 160
TCAM Utilization 31.25%

Setting the ACL Name and Type

Use the SECURITY > ACL (CONFIGURE ACL - ADD) page to create an ACL.

CLI References

See "access-list ip" on page 26-2, "show ip access-list" on page 26-9, "access-list ipv6" on page 26-11 and "show ipv6 access-list" on page 26-15 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

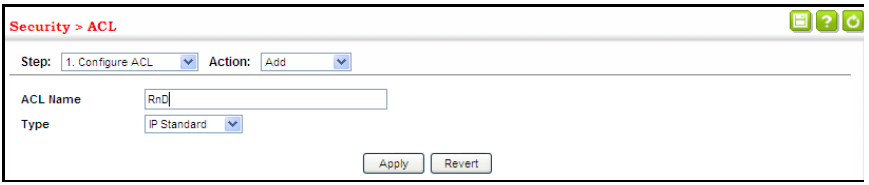
- **ACL Name** – Name of the ACL. (Maximum length: 32 characters)
- **Type** – The following filter modes are supported:
  - **IP Standard**: IPv4 ACL mode filters packets based on the source IPv4 address.
  - **IP Extended**: IPv4 ACL mode filters packets based on the source or destination IPv4 address, as well as the protocol type and protocol port number. If the "TCP" protocol is specified, then you can also filter packets based on the TCP control code.
  - **IPv6 Standard**: IPv6 ACL mode filters packets based on the source IPv6 address.
  - **IPv6 Extended**: IPv6 ACL mode filters packets based on the destination IP address, as well as DSCP, and next header type.
  - **MAC** – MAC ACL mode filters packets based on the source or destination MAC address and the Ethernet frame type (RFC 1060).
  - **ARP** – ARP ACL specifies static IP-to-MAC address bindings used for ARP inspection (see Section 14-8: "ARP Inspection" on page 14-59).

Web Interface

To configure the name and type of an ACL:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select ADD from the Action list.
4. Fill in the ACL NAME field, and select the ACL type.
5. Click APPLY.

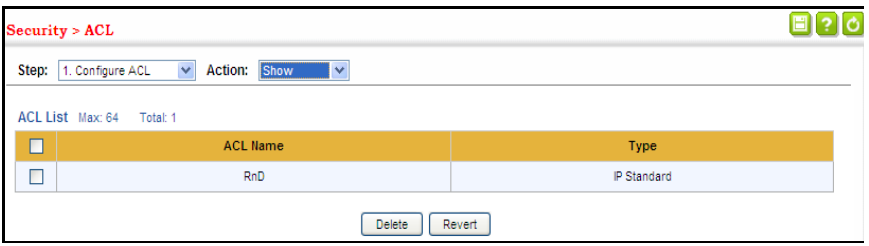
Figure 14-36. Creating an ACL



To show a list of ACLs:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select SHOW from the Action list.

Figure 14-37. Showing a List of ACLs



Configuring a Standard IPv4 ACL

Use the SECURITY > ACL (CONFIGURE ACL - ADD RULE - IP STANDARD) page to configure a Standard IPv4 ACL.

CLI References

See "permit, deny, redirect-to (Standard IP ACL)" on page 26-3, "show ip access-list" on page 26-9 and Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

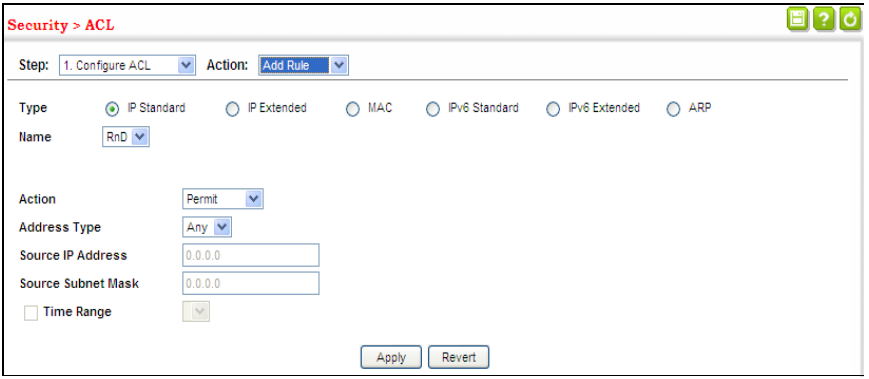
- **Type** – Selects the type of ACLs to show in the Name list.
- **Name** – Shows the names of ACLs matching the selected type.
- **Action** – An ACL can contain any combination of rules which permit or deny a packet, or re-direct a packet to another port.
- **Interface** – The unit and port to which a packet is redirected.
  (This switch does not support stacking, so the unit is fixed at 1.)
- **Address Type** – Specifies the source IP address. Use "Any" to include all possible addresses, "Host" to specify a specific host address in the Address field, or "IP" to specify a range of addresses with the Address and Subnet Mask fields. (Options: ANY, HOST, IP; Default: ANY)
- **Source IP Address** – Source IP address.
- **Source Subnet Mask** – A subnet mask containing four integers from 0 to 255, each separated by a period. The mask uses 1 bits to indicate "match" and 0 bits to indicate "ignore." The mask is bitwise ANDed with the specified source IP address, and compared with the address for each IP packet entering the port(s) to which this ACL has been assigned.
- **Time Range** – Name of a time range.

Web Interface

To add rules to a Standard IP ACL:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select ADD RULE from the Action list.
4. Select IP STANDARD from the Type list.
5. Select the name of an ACL from the Name list.
6. Specify the action (i.e., PERMIT or DENY).
7. Select the address type (ANY, HOST, or IP).
8. If you select "HOST," enter a specific address. If you select "IP," enter a subnet address and the mask for an address range.
9. Click APPLY.

Figure 14-38. Configuring a Standard IPv4 ACL



Configuring an Extended IPv4 ACL

Use the SECURITY > ACL (CONFIGURE ACL - ADD RULE - IP EXTENDED) page to configure an Extended IPv4 ACL.

CLI References

See "permit, deny, redirect-to (Extended IPv4 ACL)" on page 26-4, "show ip access-list" on page 26-9 and Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Command Usage

Due to a ASIC limitation, the switch only checks the leftmost six priority bits. This presents no problem when checking DSCP or IP Precedence bits, but limits the checking of ToS bits (underlined in the following example) to the leftmost three bits, ignoring the right most fourth bit.

For example, if you configured an access list to deny packets with a ToS of 7 (00001110), the highlighted bit would be ignored, and the access list would drop packets with a ToS of both 6 and 7.

Table 14-3. Priority Bits Processed by Extended IPv4 ACL

DSCP							
Precedence			ToS				
7	6	5	4	3	2	1	0

Parameters

These parameters are displayed in the web interface:

- **Type** – Selects the type of ACLs to show in the Name list.
- **Name** – Shows the names of ACLs matching the selected type.
- **Action** – An ACL can contain any combination of rules which permit or deny a packet, or re-direct a packet to another port.
- **Interface** – The unit and port to which a packet is redirected.
  (This switch does not support stacking, so the unit is fixed at 1.)
- **Source/Destination Address Type** – Specifies the source or destination IP address. Use "Any" to include all possible addresses, "HOST" to specify a specific host address in the Address field, or "IP" to specify a range of addresses with the Address and Subnet Mask fields. (Options: ANY, HOST, IP; Default: ANY)
- **Source/Destination IP Address** – Source or destination IP address.
- **Source/Destination Subnet Mask** – Subnet mask for source or destination address. (See the description for Subnet Mask on "Configuring a Standard IPv4 ACL" on page 14-45.)
- **Source/Destination Port** – Source/destination port number for the specified protocol type. (Range: 0-65535)
- **Source/Destination Port Bit Mask** – Decimal number representing the port bits to match. (Range: 0-65535)
- **Protocol** – Specifies the protocol type to match as TCP, UDP or Others, where others indicates a specific protocol number (0-255). (Options: TCP, UDP, Others; Default: TCP)
- **Service Type** – Packet priority settings based on the following criteria:
  - **ToS** – Type of Service level. (Range: 0-15)
  - **Precedence** – IP precedence level. (Range: 0-7)
  - **DSCP** – DSCP priority level. (Range: 0-63)
- **Control Code** – Decimal number (representing a bit string) that specifies flag bits in byte 14 of the TCP header. (Range: 0-63)
- **Control Code Bit Mask** – Decimal number representing the code bits to match. (Range: 0-63)

  The control bit mask is a decimal number (for an equivalent binary bit mask) that is applied to the control code. Enter a decimal number, where the equivalent binary bit "1" means to match a bit and "0" means to ignore a bit. The following bits may be specified:
  - **1 (fin)** – Finish
  - **2 (syn)** – Synchronize
  - **4 (rst)** – Reset
  - **8 (psh)** – Push
  - **16 (ack)** – Acknowledgement

- **32 (urg)** – Urgent pointer

For example, use the code value and mask below to catch packets with the following flags set:

- SYN flag valid, use control-code 2, control bit mask 2
- Both SYN and ACK valid, use control-code 18, control bit mask 18
- SYN valid and ACK invalid, use control-code 2, control bit mask 18

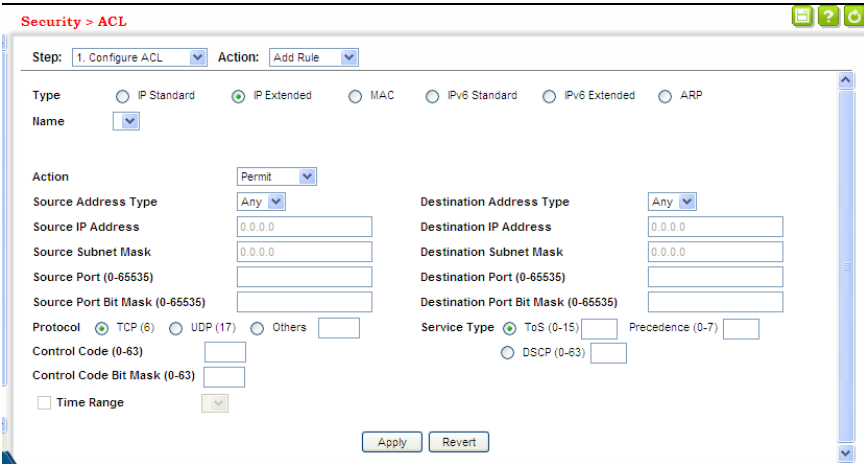
- **Time Range** – Name of a time range.

Web Interface

To add rules to an Extended IP ACL:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select ADD RULE from the Action list.
4. Select IP EXTENDED from the Type list.
5. Select the name of an ACL from the Name list.
6. Specify the action (i.e., PERMIT or DENY).
7. Select the address type (ANY, HOST, or IP).
8. If you select "HOST," enter a specific address. If you select "IP," enter a subnet address and the mask for an address range.
9. Set any other required criteria, such as service type, protocol type, or control code.
10. Click APPLY.

Figure 14-39. Configuring an Extended IPv4 ACL



Configuring a Standard IPv6 ACL

Use the SECURITY > ACL (CONFIGURE ACL - ADD RULE - IPV6 STANDARD) page to configure a Standard IPv6ACL.

CLI References

See "permit, deny, redirect-to (Standard IPv6 ACL)" on page 26-12, "show ipv6 access-list" on page 26-15 and Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Type** – Selects the type of ACLs to show in the Name list.
- **Name** – Shows the names of ACLs matching the selected type.
- **Action** – An ACL can contain any combination of rules which permit or deny a packet, or re-direct a packet to another port.
- **Interface** – The unit and port to which a packet is redirected.
  (This switch does not support stacking, so the unit is fixed at 1.)
- **Source Address Type** – Specifies the source IP address. Use "Any" to include all possible addresses, "Host" to specify a specific host address in the Address field, or "IPv6-Prefix" to specify a range of addresses. (Options: Any, Host, IPv6-Prefix; Default: Any)

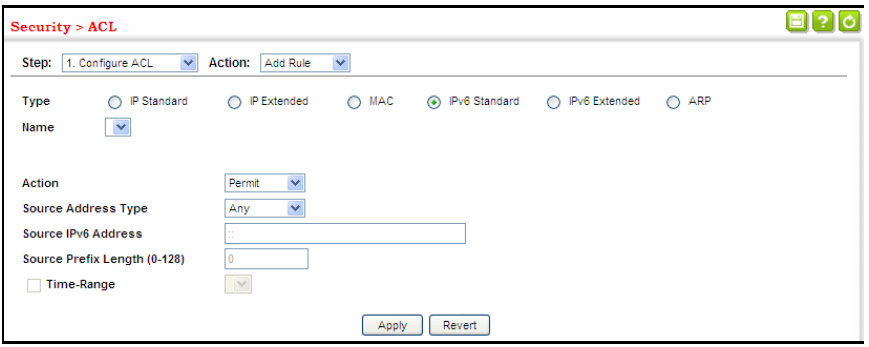
- **Source IPv6 Address** – An IPv6 source address or network class. The address must be formatted according to RFC 2373 “IPv6 Addressing Architecture,” using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.
- **Source Prefix-Length** – A decimal value indicating how many contiguous bits (from the left) of the address comprise the prefix (i.e., the network portion of the address). (Range: 0-128 bits)
- **Time Range** – Name of a time range.

Web Interface

To add rules to a Standard IPv6 ACL:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select ADD RULE from the Action list.
4. Select IPV6 STANDARD from the Type list.
5. Select the name of an ACL from the Name list.
6. Specify the action (i.e., PERMIT or DENY).
7. Select the source address type (ANY, HOST, or IPV6-PREFIX).
8. If you select “HOST,” enter a specific address. If you select “IPV6-PREFIX,” enter a subnet address and the prefix length.
9. Click APPLY.

Figure 14-40. Configuring a Standard IPv6 ACL



Configuring an Extended IPv6 ACL

Use the SECURITY > ACL (CONFIGURE ACL - ADD RULE - IPV6 EXTENDED) page to configure an Extended IPv6 ACL.

CLI References

See "permit, deny, redirect-to (Extended IPv6 ACL)" on page 26-13, "show ipv6 access-list" on page 26-15 and Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Type** – Selects the type of ACLs to show in the Name list.
- **Name** – Shows the names of ACLs matching the selected type.
- **Action** – An ACL can contain any combination of rules which permit or deny a packet, or re-direct a packet to another port.
- **Interface** – The unit and port to which a packet is redirected.
  (This switch does not support stacking, so the unit is fixed at 1.)
- **Source/Destination Address Type** – Specifies the source or destination IP address. Use "ANY" to include all possible addresses, "HOST" to specify a specific host address in the ADDRESS field, or "IPV6-PREFIX" to specify a range of addresses. (Options: ANY, HOST, IPV6-PREFIX; Default: ANY)
- **Source/Destination IPv6 Address** – An IPv6 address or network class. The address must be formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields. (The switch only checks the first 64 bits of the destination address.)
- **Source/Destination Prefix-Length** – A decimal value indicating how many contiguous bits (from the left) of the address comprise the prefix; i.e., the network portion of the address. (Range: 0-8 bits)
- **DSCP** – DSCP traffic class. (Range: 0-63)
- **Next Header** – Identifies the type of header immediately following the IPv6 header. (Range: 0-255)

  Optional internet-layer information is encoded in separate headers that may be placed between the IPv6 header and the upper-layer header in a packet. There are a small number of such extension headers, each identified by a distinct Next Header value. IPv6 supports the values defined for the IPv4 Protocol field in RFC 1700, and includes these commonly used headers:

0;	Hop-by-Hop Options	(RFC 2460)
6;	TCP Upper-layer Header	(RFC 1700)

17;	UDP Upper-layer Header	(RFC 1700)
43;	Routing	(RFC 2460)
44;	Fragment	(RFC 2460)
50;	Encapsulating Security Payload	(RFC 2406)
51;	Authentication	(RFC 2402)
60;	Destination Options	(RFC 2460)

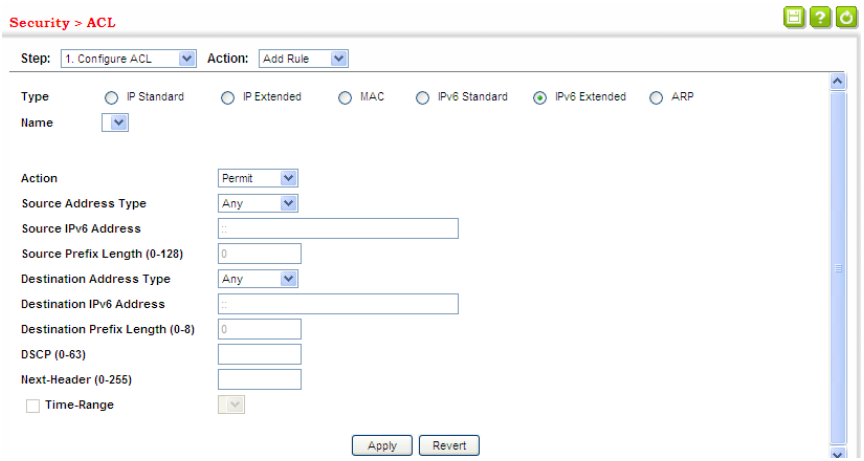
- **Time Range** – Name of a time range.

Web Interface

To add rules to an Extended IPv6 ACL:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select ADD RULE from the Action list.
4. Select IPV6 EXTENDED from the Type list.
5. Select the name of an ACL from the Name list.
6. Specify the action (i.e., PERMIT or DENY).
7. Select the address type (ANY or IPV6-PREFIX).
8. If you select "HOST," enter a specific address. If you select "IPV6-PREFIX," enter a subnet address and prefix length.
9. Set any other required criteria, such as DSCP or next header.
10. Click APPLY.

Figure 14-41. Configuring an Extended IPv6 ACL



Configuring a MAC ACL

Use the SECURITY > ACL (CONFIGURE ACL - ADD RULE - MAC) page to configure a MAC ACL based on hardware addresses, packet format, and Ethernet type.

CLI References

See "permit, deny, redirect-to (MAC ACL)" on page 26-19, "show ip access-list" on page 26-9 and Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Type** – Selects the type of ACLs to show in the Name list.
- **Name** – Shows the names of ACLs matching the selected type.
- **Action** – An ACL can contain any combination of rules which permit or deny a packet, or re-direct a packet to another port.
- **Interface** – The unit and port to which a packet is redirected.
  (This switch does not support stacking, so the unit is fixed at 1.)
- **Source/Destination Address Type** – Use "ANY" to include all possible addresses, "HOST" to indicate a specific MAC address, or "MAC" to specify an address range with the ADDRESS and BIT MASK fields. (Options: ANY, HOST, MAC; Default: ANY)
- **Source/Destination MAC Address** – Source or destination MAC address.

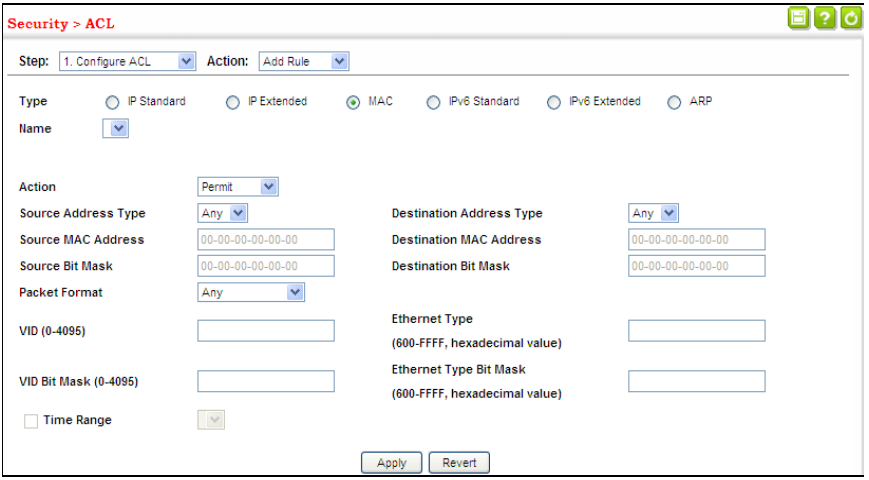
- **Source/Destination Bit Mask** – Hexadecimal mask for source or destination MAC address.
- **Packet Format** – This attribute includes the following packet types:
  - **Any** – Any Ethernet packet type.
  - **Untagged-eth2** – Untagged Ethernet II packets.
  - **Untagged-802.3** – Untagged Ethernet 802.3 packets.
  - **Tagged-eth2** – Tagged Ethernet II packets.
  - **Tagged-802.3** – Tagged Ethernet 802.3 packets.
- **VID** – VLAN ID. (Range: 1-4094)
- **VID Bit Mask** – VLAN bit mask. (Range: 0-4095)
- **Ethernet Type** – This option can only be used to filter Ethernet II formatted packets. (Range: 600-ffff hex.)
- A detailed listing of Ethernet protocol types can be found in RFC 1060. A few of the more common types include 0800 (IP), 0806 (ARP), 8137 (IPX).
- **Ethernet Type Bit Mask** – Protocol bit mask. (Range: 600-ffff hex.)
- **Time Range** – Name of a time range.

Web Interface

To add rules to a MAC ACL:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select ADD RULE from the Action list.
4. Select MAC from the Type list.
5. Select the name of an ACL from the Name list.
6. Specify the action (i.e., PERMIT or DENY).
7. Select the address type (ANY, HOST, or MAC).
8. If you select "HOST," enter a specific address (e.g., 11-22-33-44-55-66). If you select "MAC," enter a base address and a hexadecimal bit mask for an address range.
9. Set any other required criteria, such as VID, Ethernet type, or packet format.
10. Click APPLY.

Figure 14-42. Configuring a MAC ACL



Configuring an ARP ACL

Use the SECURITY > ACL (CONFIGURE ACL - ADD RULE - ARP) page to configure ACLs based on ARP message addresses. ARP Inspection can then use these ACLs to filter suspicious traffic (see "Configuring Global Settings for ARP Inspection" on page 14-60).

CLI References

See "permit, deny (ARP ACL)" on page 26-25, "show ip access-list" on page 26-9 and Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Type** – Selects the type of ACLs to show in the Name list.
- **Name** – Shows the names of ACLs matching the selected type.
- **Action** – An ACL can contain any combination of permit or deny rules.
- **Packet Type** – Indicates an ARP request, ARP response, or either type. (Range: Request, Response, All; Default: All)
- **Source/Destination IP Address Type** – Specifies the source or destination IPv4 address. Use "ANY" to include all possible addresses, "HOST" to specify a specific host address in the Address field, or "IP" to specify a range of addresses with the Address and Mask fields. (Options: ANY, HOST, IP; Default: ANY)
- **Source/Destination IP Address** – Source or destination IP address.

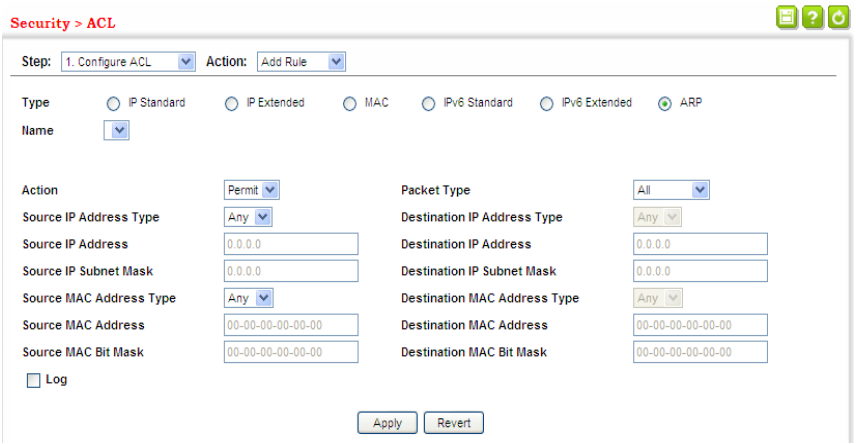
- **Source/Destination IP Subnet Mask** – Subnet mask for source or destination address. (See the description for Subnet Mask on page 14-45.)
- **Source/Destination MAC Address Type** – Use "ANY" to include all possible addresses, "HOST" to indicate a specific MAC address, or "MAC" to specify an address range with the Address and Mask fields. (Options: ANY, HOST, MAC; Default: ANY)
- **Source/Destination MAC Address** – Source or destination MAC address.
- **Source/Destination MAC Bit Mask** – Hexadecimal mask for source or destination MAC address.
- **Log** – Logs a packet when it matches the access control entry.

Web Interface

To add rules to an ARP ACL:

1. Click SECURITY > ACL.
2. Select CONFIGURE ACL from the Step list.
3. Select ADD RULE from the Action list.
4. Select ARP from the Type list.
5. Select the name of an ACL from the Name list.
6. Specify the action (i.e., PERMIT or DENY).
7. Select the packet type (REQUEST, RESPONSE, ALL).
8. Select the address type (ANY, HOST, or IP).
9. If you select "HOST," enter a specific address (e.g., 11-22-33-44-55-66). If you select "IP," enter a base address and a hexadecimal bit mask for an address range.
10. Enable logging if required.
11. Click APPLY.

Figure 14-43. Configuring a ARP ACL



Binding a Port to an Access Control List

After configuring ACLs, use the SECURITY > ACL (CONFIGURE INTERFACE) page to bind the ports that need to filter traffic to the appropriate ACLs. You can assign one IP access list and one MAC access list to any port.

CLI References

See "ip access-group" on page 26-8, "show ip access-list" on page 26-9, "mac access-group" on page 26-22, "show mac access-group" on page 26-23 and Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Command Usage

- This switch supports ACLs for ingress filtering only.
- You only bind one ACL to any port for ingress filtering.

Parameters

These parameters are displayed in the web interface:

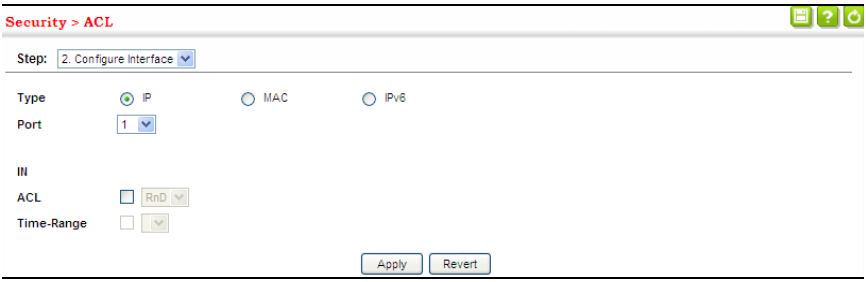
- **Type** – Selects the type of ACLs to bind to a port.
- **Port** – Fixed port or SFP module. (SSE-G2252/P: 1-52)
- **ACL** – ACL used for ingress packets.
- **Time Range** – Name of a time range.

Web Interface

To bind an ACL to a port:

1. Click SECURITY > ACL.
2. Select CONFIGURE INTERFACE from the Step list.
3. Select IP or MAC from the Type list.
4. Select a port.
5. Select the name of an ACL from the ACL list.
6. Click APPLY.

Figure 14-44. Binding a Port to an ACL



14-8 ARP Inspection

ARP Inspection is a security feature that validates the MAC Address bindings for Address Resolution Protocol packets. It provides protection against ARP traffic with invalid MAC-to-IP address bindings, which forms the basis for certain "man-in-the-middle" attacks. This is accomplished by intercepting all ARP requests and responses and verifying each of these packets before the local ARP cache is updated or the packet is forwarded to the appropriate destination. Invalid ARP packets are dropped.

ARP Inspection determines the validity of an ARP packet based on valid IP-to-MAC address bindings stored in a trusted database – the DHCP snooping binding database (see "DHCP Snooping Configuration" on page 14-91). This database is built by DHCP snooping if it is enabled on globally on the switch and on the required VLANs. ARP Inspection can also validate ARP packets against user-configured ARP access control lists (ACLs) for hosts with statically configured addresses (see "Configuring an ARP ACL" on page 14-56).

Command Usage

Enabling & Disabling ARP Inspection

- ARP Inspection is controlled on a global and VLAN basis.

- By default, ARP Inspection is disabled both globally and on all VLANs.
  - If ARP Inspection is globally enabled, then it becomes active only on the VLANs where it has been enabled.
  - When ARP Inspection is enabled globally, all ARP request and reply packets on inspection-enabled VLANs are redirected to the CPU and their switching behavior handled by the ARP Inspection engine.
  - If ARP Inspection is disabled globally, then it becomes inactive for all VLANs, including those where inspection is enabled.
  - When ARP Inspection is disabled, all ARP request and reply packets will bypass the ARP Inspection engine and their switching behavior will match that of all other packets.
  - Disabling and then re-enabling global ARP Inspection will not affect the ARP Inspection configuration of any VLANs.
  - When ARP Inspection is disabled globally, it is still possible to configure ARP Inspection for individual VLANs. These configuration changes will only become active after ARP Inspection is enabled globally again.
- The ARP Inspection engine in the current firmware version does not support ARP Inspection on trunk ports.

Configuring Global Settings for ARP Inspection

Use the SECURITY > ARP INSPECTION (CONFIGURE GENERAL) page to enable ARP inspection globally for the switch, to validate address information in each packet, and configure logging.

CLI References

See Section 25-6: "ARP Inspection" on page 25-43 for CLI reference information.

Command Usage

ARP Inspection Validation

- By default, ARP Inspection Validation is disabled.
- Specifying at least one of the following validations enables ARP Inspection Validation globally. Any combination of the following checks can be active concurrently.
  - **Destination MAC** – Checks the destination MAC address in the Ethernet header against the target MAC address in the ARP body. This check is performed for ARP responses. When enabled, packets with different MAC addresses are classified as invalid and are dropped.

- **IP** – Checks the ARP body for invalid and unexpected IP addresses. These addresses include 0.0.0.0, 255.255.255.255, and all IP multicast addresses. Sender IP addresses are checked in all ARP requests and responses, while target IP addresses are checked only in ARP responses.
- **Source MAC** – Checks the source MAC address in the Ethernet header against the sender MAC address in the ARP body. This check is performed on both ARP requests and responses. When enabled, packets with different MAC addresses are classified as invalid and are dropped.

ARP Inspection Logging

- By default, logging is active for ARP Inspection, and cannot be disabled.
- The administrator can configure the log facility rate.
- When the switch drops a packet, it places an entry in the log buffer, then generates a system message on a rate-controlled basis. After the system message is generated, the entry is cleared from the log buffer.
- Each log entry contains flow information, such as the receiving VLAN, the port number, the source and destination IP addresses, and the source and destination MAC addresses.
- If multiple, identical invalid ARP packets are received consecutively on the same VLAN, then the logging facility will only generate one entry in the log buffer and one corresponding system message.
- If the log buffer is full, the oldest entry will be replaced with the newest entry.

Parameters

These parameters are displayed in the web interface:

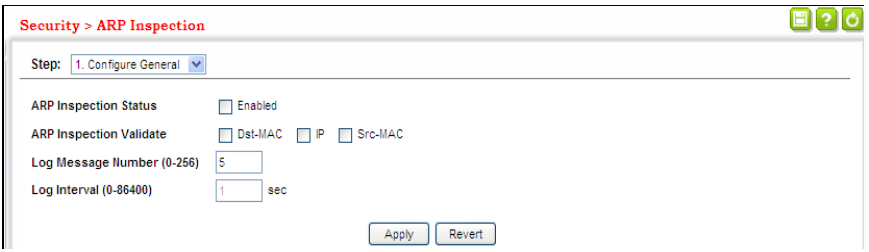
- **ARP Inspection Status** – Enables ARP Inspection globally. (Default: Disabled)
- **ARP Inspection Validation** – Enables extended ARP Inspection Validation if any of the following options are enabled. (Default: Disabled)
  - **Dst-MAC** – Validates the destination MAC address in the Ethernet header against the target MAC address in the body of ARP responses.
  - **IP** – Checks the ARP body for invalid and unexpected IP addresses. Sender IP addresses are checked in all ARP requests and responses, while target IP addresses are checked only in ARP responses.
  - **Src-MAC** – Validates the source MAC address in the Ethernet header against the sender MAC address in the ARP body. This check is performed on both ARP requests and responses.
  - **Log Message Number** – The maximum number of entries saved in a log message. (Range: 0-256; Default: 5)
- **Log Interval** – The interval at which log messages are sent. (Range: 0-86400 seconds; Default: 1 second)

Web Interface

To configure global settings for ARP Inspection:

1. Click SECURITY > ARP INSPECTION.
2. Select CONFIGURE GENERAL from the Step list.
3. Enable ARP inspection globally, enable any of the address validation options, and adjust any of the logging parameters if required.
4. Click APPLY.

Figure 14-45. Configuring Global Settings for ARP Inspection



Configuring VLAN Settings for ARP Inspection

Use the SECURITY > ARP INSPECTION (CONFIGURE VLAN) page to enable ARP inspection for any VLAN and to specify the ARP ACL to use.

CLI References

See Section 25-6: "ARP Inspection" on page 25-43 for CLI reference information.

Command Usage

ARP Inspection VLAN Filters (ACLs)

- By default, no ARP Inspection ACLs are configured and the feature is disabled.
- ARP Inspection ACLs are configured within the ARP ACL configuration page (see page 14-56).
- ARP Inspection ACLs can be applied to any configured VLAN.
- ARP Inspection uses the DHCP snooping bindings database for the list of valid IP-to-MAC address bindings. ARP ACLs take precedence over entries in the DHCP snooping bindings database. The switch first compares ARP packets to any specified ARP ACLs.
- If *Static* is specified, ARP packets are only validated against the selected ACL – packets are filtered according to any matching rules, packets not matching any rules are dropped, and the DHCP snooping bindings database check is bypassed.

- If *Static* is not specified, ARP packets are first validated against the selected ACL; if no ACL rules match the packets, then the DHCP snooping bindings database determines their validity.

Parameters

These parameters are displayed in the web interface:

- **ARP Inspection VLAN ID** – Selects any configured VLAN. (Default: 1)
- **ARP Inspection VLAN Status** – Enables ARP Inspection for the selected VLAN. (Default: Disabled)
- ARP Inspection ACL Name
  - **ARP ACL** – Allows selection of any configured ARP ACLs. (Default: None)
  - **Static** – When an ARP ACL is selected, and static mode also selected, the switch only performs ARP Inspection and bypasses validation against the DHCP Snooping Bindings database. When an ARP ACL is selected, but static mode is not selected, the switch first performs ARP Inspection and then validation against the DHCP Snooping Bindings database. (Default: Disabled)

Web Interface

To configure VLAN settings for ARP Inspection:

1. Click SECURITY > ARP INSPECTION.
2. Select CONFIGURE VLAN from the Step list.
3. Enable ARP inspection for the required VLANs, select an ARP ACL filter to check for configured addresses, and select the Static option to bypass checking the DHCP snooping bindings database if required.
4. Click APPLY.

Figure 14-46. Configuring VLAN Settings for ARP Inspection

Configuring Interface Settings for ARP Inspection

Use the SECURITY > ARP INSPECTION (CONFIGURE INTERFACE) page to specify the ports that require ARP inspection, and to adjust the packet inspection rate.

CLI References

See Section 25-6: "ARP Inspection" on page 25-43 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Port** – Port identifier.
- **Trust Status** – Configures the port as trusted or untrusted. (Default: Untrusted)

  By default, all untrusted ports are subject to ARP packet rate limiting, and all trusted ports are exempt from ARP packet rate limiting.

  Packets arriving on trusted interfaces bypass all ARP Inspection and ARP Inspection Validation checks and will always be forwarded, while those arriving on untrusted interfaces are subject to all configured ARP inspection tests.
- **Packet Rate Limit** – Sets the maximum number of ARP packets that can be processed by CPU per second on untrusted ports.
  (Range: 0-2048; Default: 15)

  Setting the rate limit to "0" means that there is no restriction on the number of ARP packets that can be processed by the CPU.

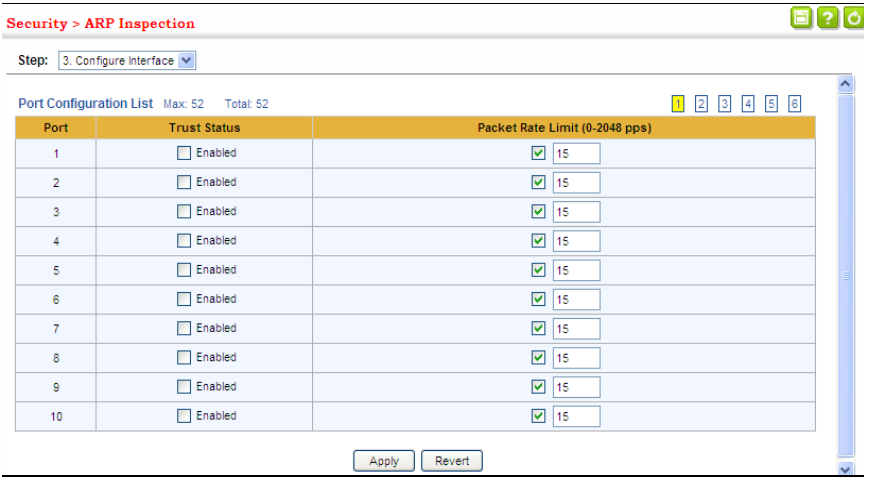
  The switch will drop all ARP packets received on a port which exceeds the configured ARP-packets-per-second rate limit.

Web Interface

To configure interface settings for ARP Inspection:

1. Click SECURITY > ARP INSPECTION.
2. Select CONFIGURE INTERFACE from the Step list.
3. Specify any untrusted ports which require ARP inspection, and adjust the packet inspection rate.
4. Click APPLY.

Figure 14-47. Configuring Interface Settings for ARP Inspection



Displaying ARP Inspection Statistics

Use the SECURITY > ARP INSPECTION (SHOW INFORMATION - SHOW STATISTICS) page to display statistics about the number of ARP packets processed, or dropped for various reasons.

CLI References

See "show ip arp inspection statistics" on page 25-51 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Table 14-4. ARP Inspection Statistics

Parameter	Description
Received ARP packets before ARP inspection rate limit	Count of ARP packets received but not exceeding the ARP Inspection rate limit.
Dropped ARP packets in the process of ARP inspection rate limit	Count of ARP packets exceeding (and dropped by) ARP rate limiting.
ARP packets dropped by additional validation (IP)	Count of ARP packets that failed the IP address test.
ARP packets dropped by additional validation (Dst-MAC)	Count of packets that failed the destination MAC address test.

Table 14-4. ARP Inspection Statistics (Continued)

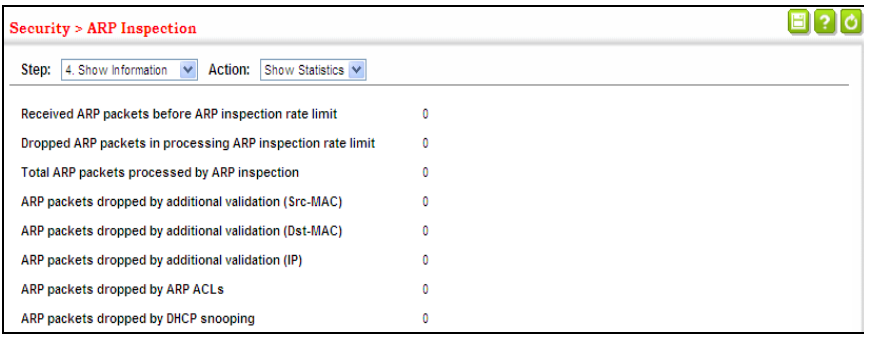
Parameter	Description
Total ARP packets processed by ARP inspection	Count of all ARP packets processed by the ARP Inspection engine.
ARP packets dropped by additional validation (Src-MAC)	Count of packets that failed the source MAC address test.
ARP packets dropped by ARP ACLs	Count of ARP packets that failed validation against ARP ACL rules.
ARP packets dropped by DHCP snooping	Count of packets that failed validation against the DHCP Snooping Binding database.

Web Interface

To display statistics for ARP Inspection:

1. Click SECURITY > ARP INSPECTION.
2. Select SHOW INFORMATION from the Step list.
3. Select SHOW STATISTICS from the Action list.

Figure 14-48. Displaying Statistics for ARP Inspection


Security > ARP Inspection
Step: 4. Show Information
Action: Show Statistics
Received ARP packets before ARP inspection rate limit 0
Dropped ARP packets in processing ARP inspection rate limit 0
Total ARP packets processed by ARP inspection 0
ARP packets dropped by additional validation (Src-MAC) 0
ARP packets dropped by additional validation (Dst-MAC) 0
ARP packets dropped by additional validation (IP) 0
ARP packets dropped by ARP ACLs 0
ARP packets dropped by DHCP snooping 0

Displaying the ARP Inspection Log

Use the SECURITY > ARP INSPECTION (SHOW INFORMATION - SHOW LOG) page to show information about entries stored in the log, including the associated VLAN, port, and address components.

CLI References

See "show ip arp inspection log" on page 25-51 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Table 14-5. ARP Inspection Log

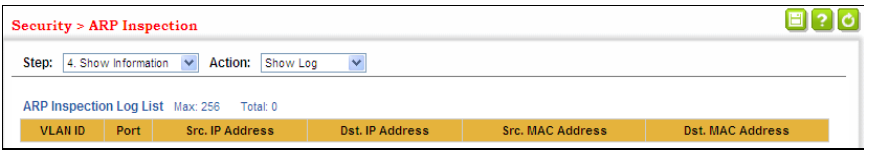
Parameter	Description
VLAN ID	The VLAN where this packet was seen.
Port	The port where this packet was seen.
Src. IP Address	The source IP address in the packet.
Dst. IP Address	The destination IP address in the packet.
Src. MAC Address	The source MAC address in the packet.
Dst. MAC Address	The destination MAC address in the packet.

Web Interface

To display the ARP Inspection log:

1. Click SECURITY > ARP INSPECTION.
2. Select SHOW INFORMATION from the Step list.
3. Select SHOW LOG from the Action list.

Figure 14-49. Displaying the ARP Inspection Log



14-9 Filtering IP Addresses for Management Access

Use the SECURITY > IP FILTER page to create a list of up to 15 IP addresses or IP address groups that are allowed management access to the switch through the web interface, SNMP, or Telnet.

CLI References

See Section 24-10: "Management IP Filter" on page 24-67 for CLI reference information.

Command Usage

- The management interfaces are open to all IP addresses by default. Once you add an entry to a filter list, access to that interface is restricted to the specified addresses.

- If anyone tries to access a management interface on the switch from an invalid address, the switch will reject the connection, enter an event message in the system log, and send a trap message to the trap manager.
- IP address can be configured for SNMP, web and Telnet access respectively. Each of these groups can include up to five different sets of addresses, either individual addresses or address ranges.
- When entering addresses for the same group (i.e., SNMP, web or Telnet), the switch will not accept overlapping address ranges. When entering addresses for different groups, the switch will accept overlapping address ranges.
- You cannot delete an individual address from a specified range. You must delete the entire range, and reenter the addresses.
- You can delete an address range just by specifying the start address, or by specifying both the start address and end address.

Parameters

These parameters are displayed in the web interface:

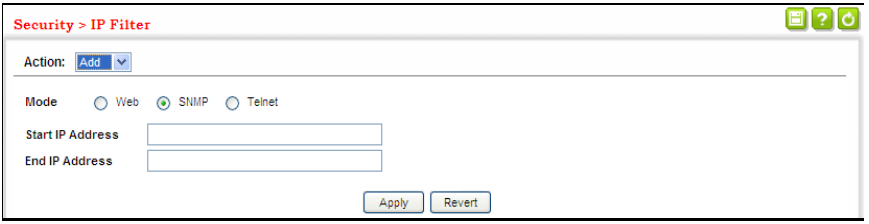
- Mode
  - **Web** – Configures IP address(es) for the web group.
  - **SNMP** – Configures IP address(es) for the SNMP group.
  - **Telnet** – Configures IP address(es) for the Telnet group.
- **Start IP Address** – A single IP address, or the starting address of a range.
- **End IP Address** – The end address of a range.

Web Interface

To create a list of IP addresses authorized for management access:

1. Click SECURITY > IP FILTER.
2. Select ADD from the Action list.
3. Select the management interface to filter (WEB, SNMP, TELNET).
4. Enter the IP addresses or range of addresses that are allowed management access to an interface.
5. Click APPLY

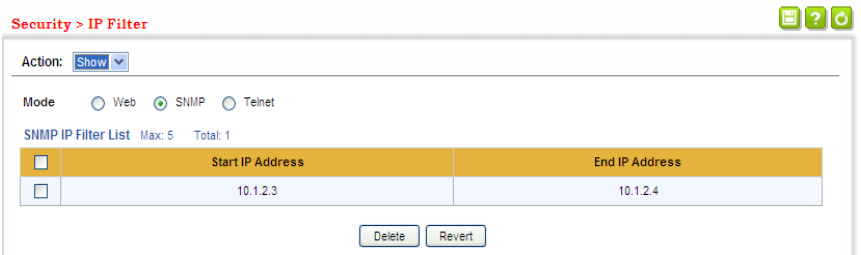
Figure 14-50. Creating an IP Address Filter for Management Access



To show a list of IP addresses authorized for management access:

1. Click SECURITY > IP FILTER.
2. Select SHOW from the Action list.

Figure 14-51. Showing IP Addresses Authorized for Management Access



14-10 Configuring Port Security

Use the SECURITY > PORT SECURITY page to configure the maximum number of device MAC addresses that can be learned by a switch port, stored in the address table, and authorized to access the network.

When port security is enabled on a port, the switch stops learning new MAC addresses on the specified port when it has reached a configured maximum number. Only incoming traffic with source addresses already stored in the address table will be authorized to access the network through that port. If a device with an unauthorized MAC address attempts to use the switch port, the intrusion will be detected and the switch can automatically take action by disabling the port and sending a trap message.

CLI References

See Section 25-1: "Port Security" on page 25-2 for CLI reference information.

Command Usage

- The default maximum number of MAC addresses allowed on a secure port is zero (that is, disabled). To use port security, you must configure the maximum number of addresses allowed on a port.
- To configure the maximum number of address entries which can be learned on a port, first disable port security on a port, and then specify the maximum number of dynamic addresses allowed. The switch will learn up to the maximum number of allowed address pairs <source MAC address, VLAN> for frames received on the port. When the port has reached the maximum number of MAC addresses, the port will stop learning new addresses. The MAC addresses already in the address table will be retained and will not be aged out.
- Note that you can manually add additional secure addresses to a port using the STATIC ADDRESS Table (page 8-1).
- If port security is enabled, and the maximum number of allowed addresses are set to a non-zero value, any device not in the address table that attempts to use the port will be prevented from accessing the switch.
- If a port is disabled (shut down) due to a security violation, it must be manually re-enabled from the INTERFACE > PORT > GENERAL page (page 6-1).
- A secure port has the following restrictions:
  - It cannot be used as a member of a static or dynamic trunk.
  - It should not be connected to a network interconnection device.

Parameters

These parameters are displayed in the web interface:

- **Port** – Port number.
- **Action** – Indicates the action to be taken when a port security violation is detected:
  - **None**: No action should be taken. (This is the default.)
  - **Trap**: Send an SNMP trap message.
  - **Shutdown**: Disable the port.
  - **Trap and Shutdown**: Send an SNMP trap message and disable the port.
- **Security Status** – Enables or disables port security on the port. (Default: Disabled)
- **Max MAC Count** – The maximum number of MAC addresses that can be learned on a port. (Range: 0 - 1024, where 0 means disabled)

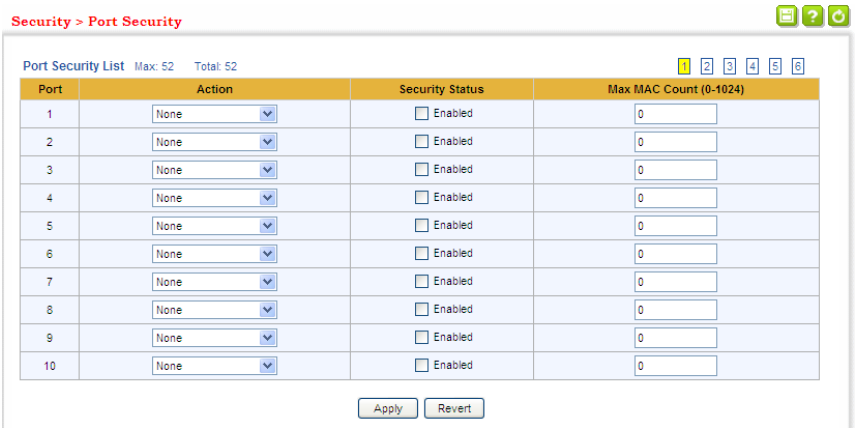
  The maximum address count is effective when port security is enabled or disabled, but can only be set when Security Status is disabled.

Web Interface

To set the maximum number of addresses which can be learned on a port:

1. Click SECURITY > PORT SECURITY.
2. If port security is enabled on the selected port, first clear the check box in SECURITY STATUS column to disable security.
3. Set the maximum number of MAC addresses allowed on the port.
4. Click APPLY.

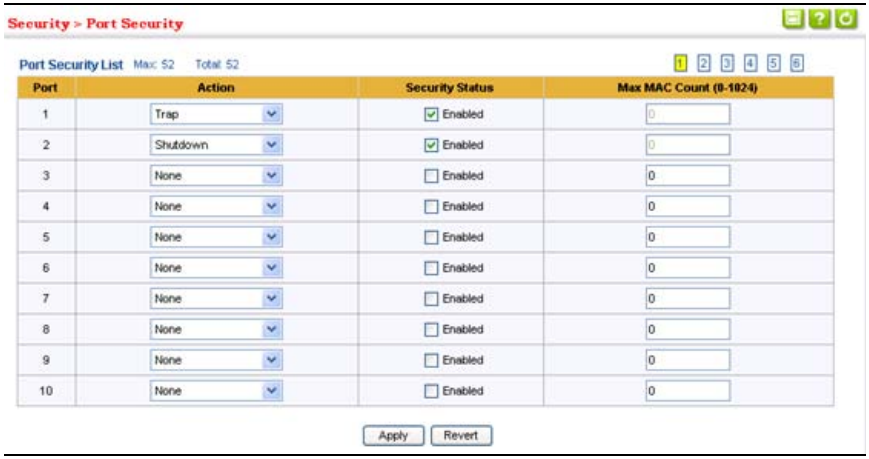
Figure 14-52. Setting the Maximum Address Count for Port Security



To enable port security:

1. Click SECURITY > PORT SECURITY.
2. Set the action to take when an invalid address is detected on a port.
3. Mark the check box in the SECURITY STATUS column to enable security.
4. Click APPLY.

Figure 14-53. Configuring the Status and Response for Port Security



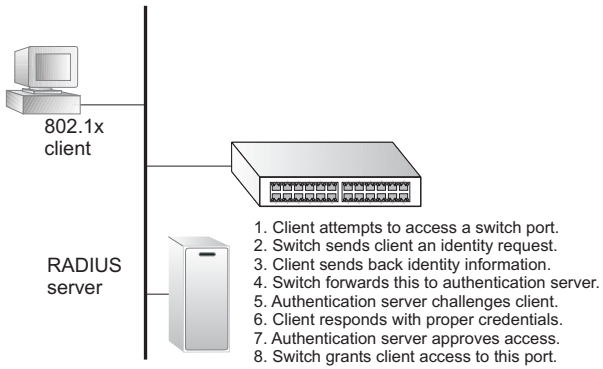
14-11 Configuring 802.1X Port Authentication

Network switches can provide open and easy access to network resources by simply attaching a client PC. Although this automatic configuration and access is a desirable feature, it also allows unauthorized personnel to easily intrude and possibly gain access to sensitive network data.

The IEEE 802.1X (dot1X) standard defines a port-based access control procedure that prevents unauthorized access to a network by requiring users to first submit credentials for authentication. Access to all switch ports in a network can be centrally controlled from a server, which means that authorized users can use the same credentials for authentication from any point within the network.

This switch uses the Extensible Authentication Protocol over LANs (EAPOL) to exchange authentication protocol messages with the client, and a remote RADIUS authentication server to verify user identity and access rights. When a client (i.e., Supplicant) connects to a switch port, the switch (i.e., Authenticator) responds with an EAPOL identity request. The client provides its identity (such as a user name) in an EAPOL response to the switch, which it forwards to the RADIUS server. The RADIUS server verifies the client identity and sends an access challenge back to the client. The EAP packet from the RADIUS server contains not only the challenge, but the authentication method to be used. The client can reject the authentication method and request another, depending on the configuration of the client software and the RADIUS server. The encryption method used to pass authentication messages can be MD5 (Message-Digest 5), TLS (Transport Layer Security), PEAP (Protected Extensible Authentication Protocol), or TTLS (Tunneled Transport Layer Security). The client responds to the appropriate method with its credentials, such as a password or certificate. The RADIUS server verifies the client credentials and responds with an accept or reject packet. If authentication is successful, the switch allows the client to access the network. Otherwise, non-EAP traffic on the port is blocked or assigned to a guest VLAN based on the “intrusion-action” setting. In “multi-host” mode, only one host connected to a port needs to pass authentication for all other hosts to be granted network access. Similarly, a port can become unauthorized for all hosts if one attached host fails re-authentication or sends an EAPOL logoff message.

Figure 14-54. Configuring Port Security


802.1x
client
RADIUS
server
1. Client attempts to access a switch port.
2. Switch sends client an identity request.
3. Client sends back identity information.
4. Switch forwards this to authentication server.
5. Authentication server challenges client.
6. Client responds with proper credentials.
7. Authentication server approves access.
8. Switch grants client access to this port.

The operation of 802.1X on the switch requires the following:

- The switch must have an IP address assigned.
- RADIUS authentication must be enabled on the switch and the IP address of the RADIUS server specified.
- 802.1X must be enabled globally for the switch.
- Each switch port that will be used must be set to dot1X “AUTO” mode.
- Each client that needs to be authenticated must have dot1X client software installed and properly configured.

- The RADIUS server and 802.1X client support EAP. (The switch only supports EAPOL in order to pass the EAP packets from the server to the client.)
- The RADIUS server and client also have to support the same EAP authentication type – MD5, PEAP, TLS, or TTLS. (Native support for these encryption methods is provided in Windows 7, Vista, and XP, and in Windows 2000 with Service Pack 4. To support these encryption methods in Windows 95 and 98, you can use the AEGIS dot1x client or other comparable client software)

Configuring 802.1X Global Settings

Use the SECURITY > PORT AUTHENTICATION (CONFIGURE GLOBAL) page to configure IEEE 802.1X port authentication. The 802.1X protocol must be enabled globally for the switch system before port settings are active.

CLI References

See Section 24-9: "802.1X Port Authentication" on page 24-46 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Port Authentication Status** – Sets the global setting for 802.1X. (Default: Disabled)
- **EAPOL Pass Through** – Passes EAPOL frames through to all ports in STP forwarding state when dot1x is globally disabled. (Default: Disabled)
- When this device is functioning as intermediate node in the network and does not need to perform dot1x authentication, **EAPOL Pass Through** can be enabled to allow the switch to forward EAPOL frames from other switches on to the authentication servers, thereby allowing the authentication process to still be carried out by switches located on the edge of the network.
- When this device is functioning as an edge switch but does not require any attached clients to be authenticated, **EAPOL Pass Through** can be disabled to discard unnecessary EAPOL traffic.
- **Identity Profile User Name** – The dot1x supplicant user name. (Range: 1-8 characters)

  The global supplicant user name and password are used to identify this switch as a supplicant when responding to an MD5 challenge from the authenticator. These parameters must be set when this switch passes client authentication requests to another authenticator on the network (see "Configuring Port Supplicant Settings for 802.1X" on page 14-79).
- **Set Password** – Allows the dot1x supplicant password to be entered.

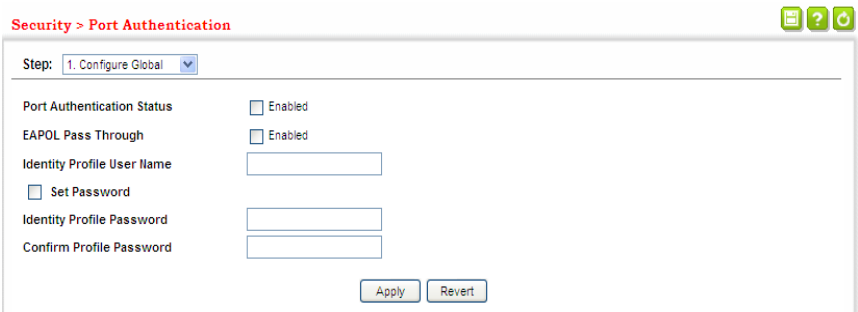
- **Identity Profile Password** – The dot1x supplicant password used to identify this switch as a supplicant when responding to an MD5 challenge from the authenticator. (Range: 1-8 characters)
- **Confirm Profile Password** – This field is used to confirm the dot1x supplicant password.

Web Interface

To configure global settings for 802.1X:

1. Click SECURITY > PORT AUTHENTICATION.
2. Select CONFIGURE GLOBAL from the Step list.
3. Enable 802.1X globally for the switch, and configure EAPOL PASS THROUGH if required. Then set the user name and password to use when the switch responds an MD5 challenge from the authentication server.
4. Click APPLY

Figure 14-55. Configuring Global Settings for 802.1X Port Authentication



Configuring Port Authenticator Settings for 802.1X

Use the SECURITY > PORT AUTHENTICATION (CONFIGURE INTERFACE – AUTHENTICATOR) page to configure 802.1X port settings for the switch as the local authenticator. When 802.1X is enabled, you need to configure the parameters for the authentication process that runs between the client and the switch (i.e., authenticator), as well as the client identity lookup process that runs between the switch and authentication server.

CLI References

See Section 24-9: "802.1X Port Authentication" on page 24-46 for CLI reference information.

Command Usage

- When the switch functions as a local authenticator between supplicant devices attached to the switch and the authentication server, configure the parameters for the exchange of EAP messages between the authenticator and clients on the Authenticator configuration page.
- When devices attached to a port must submit requests to another authenticator on the network, configure the Identity Profile parameters on the Configure Global page (see "Configuring 802.1X Global Settings" on page 14-74) which identify this switch as a supplicant, and configure the supplicant parameters for those ports which must authenticate clients through the remote authenticator (see "Configuring Port Supplicant Settings for 802.1X" on page 14-79).
- This switch can be configured to serve as the authenticator on selected ports by setting the Control Mode to Auto on this configuration page, and as a supplicant on other ports by the setting the control mode to Force-Authorized on this page and enabling the PAE supplicant on the Supplicant configuration page.

Parameters

These parameters are displayed in the web interface:

- **Port** – Port number.
- **Status** – Indicates if authentication is enabled or disabled on the port. The status is disabled if the control mode is set to Force-Authorized.
- **Authorized** – Displays the 802.1X authorization status of connected clients.
  - **Yes –** Connected client is authorized.
  - **No** – Connected client is not authorized.
- **Supplicant** – Indicates the MAC address of a connected client.
- **Control Mode** – Sets the authentication mode to one of the following options:
  - **Auto** – Requires a dot1x-aware client to be authorized by the authentication server. Clients that are not dot1x-aware will be denied access.
  - **Force-Authorized** – Forces the port to grant access to all clients, either dot1x-aware or otherwise. (This is the default setting.)
  - **Force-Unauthorized** – Forces the port to deny access to all clients, either dot1x-aware or otherwise.
- **Operation Mode** – Allows single or multiple hosts (clients) to connect to an 802.1X-authorized port. (Default: Single-Host)
  - **Single-Host** – Allows only a single host to connect to this port.
  - **Multi-Host** – Allows multiple host to connect to this port.

In this mode, only one host connected to a port needs to pass authentication for all other hosts to be granted network access. Similarly, a port can become unauthorized for all hosts if one attached host fails re-authentication or sends an EAPOL logoff message.

- **MAC-Based** – Allows multiple hosts to connect to this port, with each host needing to be authenticated.

  In this mode, each host connected to a port needs to pass authentication. The number of hosts allowed access to a port operating in this mode is limited only by the available space in the secure address table (i.e., up to 1024 addresses).

- **Max MAC Count** – The maximum number of hosts that can connect to a port when the Multi-Host operation mode is selected. (Range: 1-1024; Default: 5)
- **Max-Request** – Sets the maximum number of times the switch port will retransmit an EAP request packet to the client before it times out the authentication session. (Range: 1-10; Default 2)
- **Quiet Period** – Sets the time that a switch port waits after the Max Request Count has been exceeded before attempting to acquire a new client.
  (Range: 1-65535 seconds; Default: 60 seconds)
- **Tx Period** – Sets the time period during an authentication session that the switch waits before re-transmitting an EAP packet. (Range: 1-65535; Default: 30 seconds)
- **Supplicant Timeout** – Sets the time that a switch port waits for a response to an EAP request from a client before re-transmitting an EAP packet. (Range: 1-65535; Default: 30 seconds)

  This command attribute sets the timeout for EAP-request frames other than EAP-request/identity frames. If dot1x authentication is enabled on a port, the switch will initiate authentication when the port link state comes up. It will send an EAP-request/identity frame to the client to request its identity, followed by one or more requests for authentication information. It may also send other EAP-request frames to the client during an active connection as required for reauthentication.

- **Server Timeout** – Sets the time that a switch port waits for a response to an EAP request from an authentication server before re-transmitting an EAP packet. (Fixed Setting: 10 seconds)
- **Re-authentication Status** – Sets the client to be re-authenticated after the interval specified by the Re-authentication Period. Re-authentication can be used to detect if a new device is plugged into a switch port. (Default: Disabled)
- **Re-authentication Period** – Sets the time period after which a connected client must be re-authenticated. (Range: 1-65535 seconds; Default: 3600 seconds)
- **Intrusion Action** – Sets the port's response to a failed authentication.

  - **Block Traffic** – Blocks all non-EAP traffic on the port. (This is the default setting.)

- **Guest VLAN** – All traffic for the port is assigned to a guest VLAN. The guest VLAN must be separately configured (See "Configuring VLAN Groups" on page 7-4) and mapped on each port (See "Configuring Network Access for Ports" on page 14-25).

Authenticator PAE State Machine

- **State** – Current state (including initialize, disconnected, connecting, authenticating, authenticated, aborting, held, force_authorized, force_unauthorized).
- **Reauth Count** – Number of times connecting state is re-entered.
- **Current Identifier** – Identifier sent in each EAP Success, Failure or Request packet by the Authentication Server.

Backend State Machine

- **State** – Current state (including request, response, success, fail, timeout, idle, initialize).
- **Request Count** – Number of EAP Request packets sent to the Supplicant without receiving a response.
- **Identifier (Server)** – Identifier carried in the most recent EAP Success, Failure or Request packet received from the Authentication Server.

Reauthentication State Machine

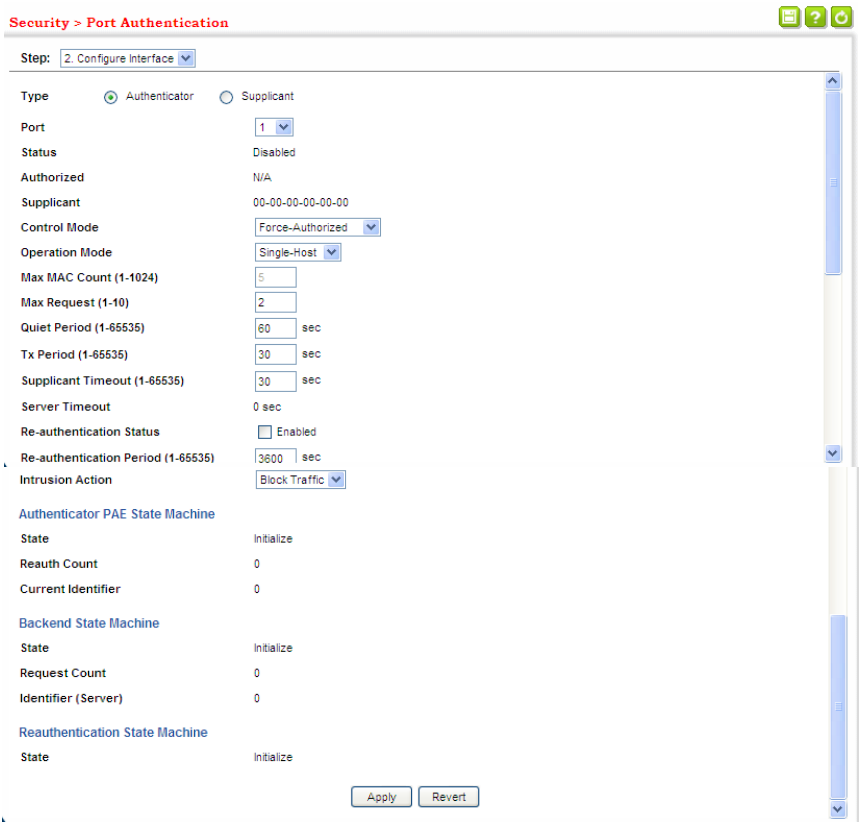
- **State** – Current state (including initialize, reauthenticate).

Web Interface

To configure port authenticator settings for 802.1X:

1. Click SECURITY > PORT AUTHENTICATION.
2. Select CONFIGURE INTERFACE from the Step list.
3. Click AUTHENTICATOR.
4. Modify the authentication settings for each port as required.
5. Click APPLY

Figure 14-56. Configuring Interface Settings for 802.1X Port Authenticator



Configuring Port Supplicant Settings for 802.1X

Use the SECURITY > PORT AUTHENTICATION (CONFIGURE INTERFACE – SUPPLICANT) page to configure 802.1X port settings for supplicant requests issued from a port to an authenticator on another device. When 802.1X is enabled and the control mode is set to Force-Authorized (see "Configuring Port Authenticator Settings for 802.1X" on page 14-75), you need to configure the parameters for the client supplicant process if the client must be authenticated through another device in the network.

CLI References

See Section 24-9: "802.1X Port Authentication" on page 24-46 for CLI reference information.

Command Usage

- When devices attached to a port must submit requests to another authenticator on the network, configure the Identity Profile parameters on the Configure Global page (see "Configuring 802.1X Global Settings" on page 14-74) which identify this switch as a supplicant, and configure the supplicant parameters for those ports which must authenticate clients through the remote authenticator on this configuration page. When PAE supplicant mode is enabled on a port, it will not respond to dot1x messages meant for an authenticator.
- This switch can be configured to serve as the authenticator on selected ports by setting the Control Mode to Auto on the Authenticator configuration page, and as a supplicant on other ports by the setting the control mode to Force-Authorized on that configuration page and enabling the PAE supplicant on the Supplicant configuration page.

Parameters

These parameters are displayed in the web interface:

- **Port** – Port number.
- **PAE Supplicant** – Enables PAE supplicant mode. (Default: Disabled)

  If the attached client must be authenticated through another device in the network, supplicant status must be enabled.

  Supplicant status can only be enabled if PAE Control Mode is set to "FORCE-AUTHORIZED" on this port (see "Configuring Port Authenticator Settings for 802.1X" on page 14-75).

  PAE supplicant status cannot be enabled if a port is a member of trunk or LACP is enabled on the port.
- **Authentication Period** – The time that a supplicant port waits for a response from the authenticator. (Range: 1-65535 seconds; Default: 30 seconds)
- **Hold Period** – The time that a supplicant port waits before resending its credentials to find a new an authenticator. (Range: 1-65535 seconds; Default: 30 seconds)
- **Start Period** – The time that a supplicant port waits before resending an EAPOL start frame to the authenticator. (Range: 1-65535 seconds; Default: 30 seconds)
- **Maximum Start** – The maximum number of times that a port supplicant will send an EAP start frame to the client before assuming that the client is 802.1X unaware. (Range: 1-65535; Default: 3)
- **Authenticated** – Shows whether or not the supplicant has been authenticated.

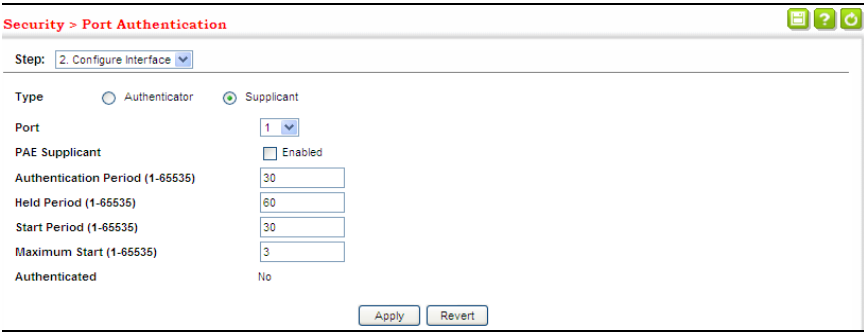
Web Interface

To configure port authenticator settings for 802.1X:

1. Click SECURITY > PORT AUTHENTICATION.
2. Select CONFIGURE INTERFACE from the Step list.

3. Click SUPPLICANT.
4. Modify the supplicant settings for each port as required.
5. Click APPLY

Figure 14-57. Configuring Interface Settings for 802.1X Port Supplicant



Displaying 802.1X Statistics

Use the SECURITY > PORT AUTHENTICATION (SHOW STATISTICS) page to display statistics for dot1x protocol exchanges for any port.

CLI References

See "show dot1x" on page 24-64 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Table 14-6. 802.1X Statistics

Parameter	Description
Authenticator	
Rx EAPOL Start	The number of EAPOL Start frames that have been received by this Authenticator.
Rx EAPOL Logoff	The number of EAPOL Logoff frames that have been received by this Authenticator.
Rx EAPOL Invalid	The number of EAPOL frames that have been received by this Authenticator in which the frame type is not recognized.
Rx EAPOL Total	The number of valid EAPOL frames of any type that have been received by this Authenticator.
Rx Last EAPOLVer	The protocol version number carried in the most recent EAPOL frame received by this Authenticator.

Table 14-6. 802.1X Statistics (Continued)

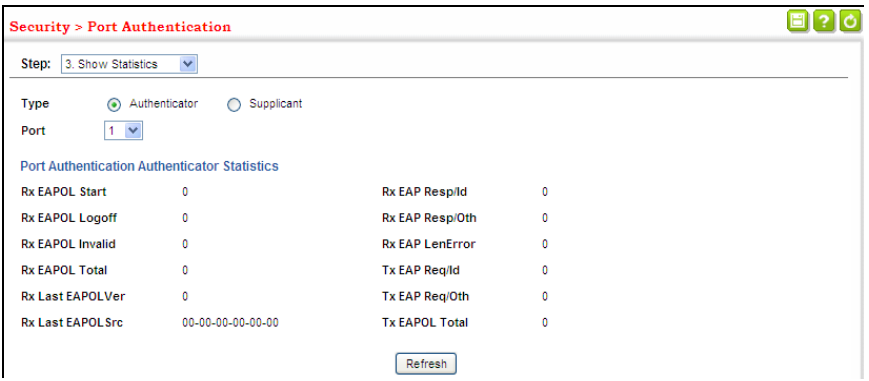
Parameter	Description
Rx Last EAPOLSrc	The source MAC address carried in the most recent EAPOL frame received by this Authenticator.
Rx EAP Resp/Id	The number of EAP Resp/Id frames that have been received by this Authenticator.
Rx EAP Resp/Oth	The number of valid EAP Response frames (other than Resp/Id frames) that have been received by this Authenticator.
Rx EAP LenError	The number of EAPOL frames that have been received by this Authenticator in which the Packet Body Length field is invalid.
Tx EAP Req/Id	The number of EAP Req/Id frames that have been transmitted by this Authenticator.
Tx EAP Req/Oth	The number of EAP Request frames (other than Rq/Id frames) that have been transmitted by this Authenticator.
Tx EAPOL Total	The number of EAPOL frames of any type that have been transmitted by this Authenticator.
Supplicant	
Rx EAPOL Invalid	The number of EAPOL frames that have been received by this Supplicant in which the frame type is not recognized.
Rx EAPOL Total	The number of valid EAPOL frames of any type that have been received by this Supplicant.
Rx Last EAPOLVer	The protocol version number carried in the most recent EAPOL frame received by this Supplicant.
Rx Last EAPOLSrc	The source MAC address carried in the most recent EAPOL frame received by this Supplicant.
Rx EAP Resp/Id	The number of EAP Resp/Id frames that have been received by this Supplicant.
Rx EAP Resp/Oth	The number of valid EAP Response frames (other than Resp/Id frames) that have been received by this Supplicant.
Rx EAP LenError	The number of EAPOL frames that have been received by this Supplicant in which the Packet Body Length field is invalid.
Tx EAPOL Total	The number of EAPOL frames of any type that have been transmitted by this Supplicant.
Tx EAPOL Start	The number of EAPOL Start frames that have been transmitted by this Supplicant.
Tx EAPOL Logoff	The number of EAPOL Logoff frames that have been transmitted by this Supplicant.
Tx EAP Req/Id	The number of EAP Req/Id frames that have been transmitted by this Supplicant.
Tx EAP Req/Oth	The number of EAP Request frames (other than Rq/Id frames) that have been transmitted by this Supplicant.

Web Interface

To display port authenticator statistics for 802.1X:

1. Click SECURITY > PORT AUTHENTICATION.
2. Select SHOW STATISTICS from the Step list.
3. Click AUTHENTICATOR.

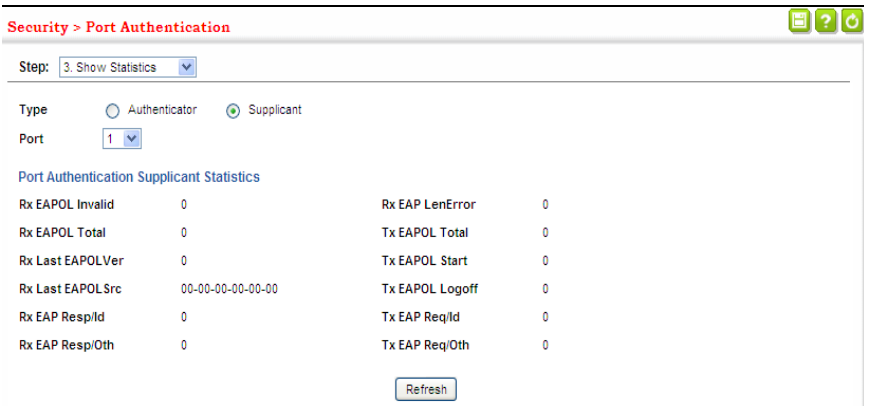
Figure 14-58. Showing Statistics for 802.1X Port Authenticator



To display port supplicant statistics for 802.1X:

1. Click SECURITY > PORT AUTHENTICATION.
2. Select SHOW STATISTICS from the Step list.
3. Click SUPPLICANT.

Figure 14-59. Showing Statistics for 802.1X Port Supplicant



14-12 IP Source Guard

IP Source Guard is a security feature that filters IP traffic on network interfaces based on manually configured entries in the IP Source Guard table, or dynamic entries in the DHCP Snooping table when enabled (see "DHCP Snooping" on page 14-89). IP source guard can be used to prevent traffic attacks caused when a host tries to use the IP address of a neighbor to access the network. This section describes commands used to configure IP Source Guard.

Configuring Ports for IP Source Guard

Use the SECURITY > IP SOURCE GUARD > PORT CONFIGURATION page to set the filtering type based on source IP address, or source IP address and MAC address pairs.

IP Source Guard is used to filter traffic on an insecure port which receives messages from outside the network or fire wall, and therefore may be subject to traffic attacks caused by a host trying to use the IP address of a neighbor.

CLI References

See "ip source-guard" on page 25-39 for CLI reference information.

Command Usage

- Setting source guard mode to SIP (Source IP) or SIP-MAC (Source IP and MAC) enables this function on the selected port. Use the SIP option to check the VLAN ID, source IP address, and port number against all entries in the binding table. Use the SIP-MAC option to check these same parameters, plus the source MAC address. If no matching entry is found, the packet is dropped.

NOTE: Multicast addresses cannot be used by IP Source Guard.

- When enabled, traffic is filtered based upon dynamic entries learned via DHCP snooping (see Section 14-13: "DHCP Snooping" on page 14-89), or static addresses configured in the source guard binding table.
- If IP source guard is enabled, an inbound packet's IP address (SIP option) or both its IP address and corresponding MAC address (SIP-MAC option) will be checked against the binding table. If no matching entry is found, the packet will be dropped.
- Filtering rules are implemented as follows:
  - If DHCP snooping is disabled (see page 14-91), IP source guard will check the VLAN ID, source IP address, port number, and source MAC address (for the SIP-MAC option). If a matching entry is found in the binding table and the entry type is static IP source guard binding, the packet will be forwarded.

- If DHCP snooping is enabled, IP source guard will check the VLAN ID, source IP address, port number, and source MAC address (for the SIP-MAC option). If a matching entry is found in the binding table and the entry type is static IP source guard binding, or dynamic DHCP snooping binding, the packet will be forwarded.
- If IP source guard if enabled on an interface for which IP source bindings have not yet been configured (neither by static configuration in the IP source guard binding table nor dynamically learned from DHCP snooping), the switch will drop all IP traffic on that port, except for DHCP packets.

Parameters

These parameters are displayed in the web interface:

- **Filter Type** – Configures the switch to filter inbound traffic based source IP address, or source IP address and corresponding MAC address. (Default: None)
  - **None** – Disables IP source guard filtering on the port.
  - **SIP** – Enables traffic filtering based on IP addresses stored in the binding table.
  - **SIP-MAC** – Enables traffic filtering based on IP addresses and corresponding MAC addresses stored in the binding table.
- **Max Binding Entry** – The maximum number of entries that can be bound to an interface. (Range: 1-5; Default: 5)

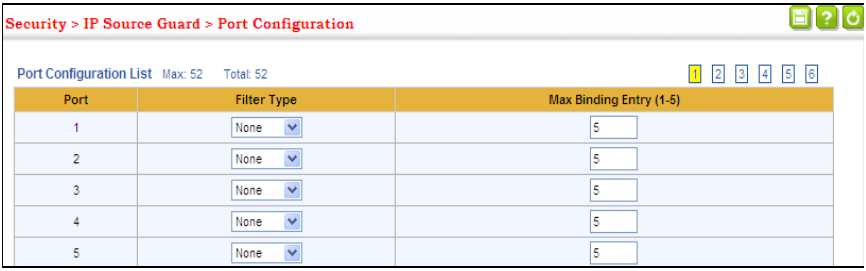
  This parameter sets the maximum number of address entries that can be mapped to an interface in the binding table, including both dynamic entries discovered by DHCP snooping (see Section 14-13: "DHCP Snooping" on page 14-89) and static entries set by IP source guard (see "Configuring Static Bindings for IP Source Guard" on page 14-86).

Web Interface

To set the IP Source Guard filter for ports:

1. Click SECURITY > IP SOURCE GUARD > PORT CONFIGURATION .
2. Set the required filtering type for each port.
3. Click APPLY

Figure 14-60. Setting the Filter Type for IP Source Guard



Configuring Static Bindings for IP Source Guard

Use the SECURITY > IP SOURCE GUARD > STATIC CONFIGURATION page to bind a static address to a port. Table entries include a MAC address, IP address, lease time, entry type (Static, Dynamic), VLAN identifier, and port identifier. All static entries are configured with an infinite lease time, which is indicated with a value of zero in the table.

CLI References

See "ip source-guard binding" on page 25-38 for CLI reference information.

Command Usage

- Static addresses entered in the source guard binding table are automatically configured with an infinite lease time. Dynamic entries learned via DHCP snooping are configured by the DHCP server itself.
- Static bindings are processed as follows:
  - If there is no entry with the same VLAN ID and MAC address, a new entry is added to the binding table using the type "static IP source guard binding."
  - If there is an entry with the same VLAN ID and MAC address, and the type of entry is static IP source guard binding, then the new entry will replace the old one.
  - If there is an entry with the same VLAN ID and MAC address, and the type of the entry is dynamic DHCP snooping binding, then the new entry will replace the old one and the entry type will be changed to static IP source guard binding.
  - Only unicast addresses are accepted for static bindings.

Parameters

These parameters are displayed in the web interface:

- **Port** – The port to which a static entry is bound.
- **VLAN** – ID of a configured VLAN (Range: 1-4093)

- **MAC Address** – A valid unicast MAC address.
- **IP Address** – A valid unicast IP address, including classful types A, B or C.

Web Interface

To configure static bindings for IP Source Guard:

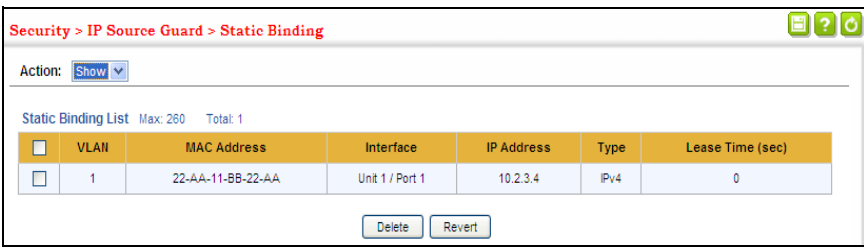
1. Click SECURITY > IP SOURCE GUARD > STATIC CONFIGURATION.
2. Select ADD from the Action list.
3. Enter the required bindings for each port.
4. Click APPLY

Figure 14-61. Configuring Static Bindings for IP Source Guard

To display static bindings for IP Source Guard:

1. Click SECURITY > IP SOURCE GUARD > STATIC CONFIGURATION.
2. Select SHOW from the Action list.

Figure 14-62. Displaying Static Bindings for IP Source Guard



Displaying Information for Dynamic IP Source Guard Bindings

Use the SECURITY > IP SOURCE GUARD > DYNAMIC BINDING page to display the source-guard binding table for a selected interface.

CLI References

See "show ip dhcp snooping binding" on page 25-37 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Query by

- **Port** – A port on this switch.
- **VLAN** – ID of a configured VLAN (Range: 1-4093)
- **MAC Address** – A valid unicast MAC address.
- **IP Address** – A valid unicast IP address, including classful types A, B or C.

Dynamic Binding List

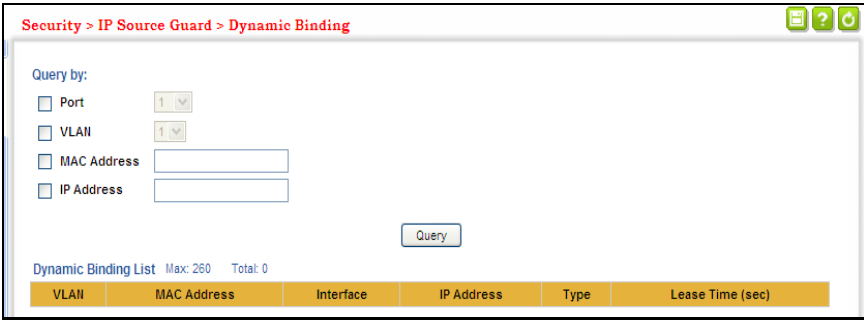
- **VLAN** – VLAN to which this entry is bound.
- **MAC Address** – Physical address associated with the entry.
- **Interface** – Port to which this entry is bound.
- **IP Address** – IP address corresponding to the client.
- **Type** – Static or dynamic binding.
- **Lease Time** – The time for which this IP address is leased to the client.

Web Interface

To display the binding table for IP Source Guard:

1. Click SECURITY > IP SOURCE GUARD > DYNAMIC BINDING.
2. Mark the search criteria, and enter the required values.
3. Click QUERY

Figure 14-63. Showing the IP Source Guard Binding Table



14-13 DHCP Snooping

The addresses assigned to DHCP clients on insecure ports can be carefully controlled using the dynamic bindings registered with DHCP Snooping (or using the static bindings configured with IP Source Guard). DHCP snooping allows a switch to protect a network from rogue DHCP servers or other devices which send port-related information to a DHCP server. This information can be useful in tracking an IP address back to a physical port.

Command Usage

DHCP Snooping Process

- Network traffic may be disrupted when malicious DHCP messages are received from an outside source. DHCP snooping is used to filter DHCP messages received on a non-secure interface from outside the network or fire wall. When DHCP snooping is enabled globally and enabled on a VLAN interface, DHCP messages received on an untrusted interface from a device not listed in the DHCP snooping table will be dropped.
- Table entries are only learned for trusted interfaces. An entry is added or removed dynamically to the DHCP snooping table when a client receives or releases an IP address from a DHCP server. Each entry includes a MAC address, IP address, lease time, VLAN identifier, and port identifier.
- The rate limit for the number of DHCP messages that can be processed by the switch is 100 packets per second. Any DHCP packets in excess of this limit are dropped.
- When DHCP snooping is enabled, DHCP messages entering an untrusted interface are filtered based upon dynamic entries learned via DHCP snooping.
- Filtering rules are implemented as follows:
  - If the global DHCP snooping is disabled, all DHCP packets are forwarded.

- If DHCP snooping is enabled globally, and also enabled on the VLAN where the DHCP packet is received, all DHCP packets are forwarded for a *trusted* port. If the received packet is a DHCP ACK message, a dynamic DHCP snooping entry is also added to the binding table.
- If DHCP snooping is enabled globally, and also enabled on the VLAN where the DHCP packet is received, but the port is *not trusted*, it is processed as follows:
- If the DHCP packet is a reply packet from a DHCP server (including OFFER, ACK or NAK messages), the packet is dropped.
- If the DHCP packet is from a client, such as a DECLINE or RELEASE message, the switch forwards the packet only if the corresponding entry is found in the binding table.
- If the DHCP packet is from a client, such as a DISCOVER, REQUEST, INFORM, DECLINE or RELEASE message, the packet is forwarded if MAC address verification is disabled. However, if MAC address verification is enabled, then the packet will only be forwarded if the client's hardware address stored in the DHCP packet is the same as the source MAC address in the Ethernet header.
- If the DHCP packet is not a recognizable type, it is dropped.
- If a DHCP packet from a client passes the filtering criteria above, it will only be forwarded to trusted ports in the same VLAN.
- If a DHCP packet is from server is received on a trusted port, it will be forwarded to both trusted and untrusted ports in the same VLAN.
- If the DHCP snooping is globally disabled, all dynamic bindings are removed from the binding table.
- *Additional considerations when the switch itself is a DHCP client* – The port(s) through which the switch submits a client request to the DHCP server must be configured as trusted. Note that the switch will not add a dynamic entry for itself to the binding table when it receives an ACK message from a DHCP server. Also, when the switch sends out DHCP client packets for itself, no filtering takes place. However, when the switch receives any messages from a DHCP server, any packets received from untrusted ports are dropped.

DHCP Snooping Option 82

- DHCP provides a relay mechanism for sending information about its DHCP clients or the relay agent itself to the DHCP server. Also known as DHCP Option 82, it allows compatible DHCP servers to use the information when assigning IP addresses, or to set other services or policies for clients. It is also an effective tool in preventing malicious network attacks from attached clients on DHCP services, such as IP Spoofing, Client Identifier Spoofing, MAC Address Spoofing, and Address Exhaustion.
- DHCP Snooping must be enabled for Option 82 information to be inserted into request packets.

- When the DHCP Snooping Information Option 82 is enabled, the requesting client (or an intermediate relay agent that has used the information fields to describe itself) can be identified in the DHCP request packets forwarded by the switch and in reply packets sent back from the DHCP server. This information may specify the MAC address or IP address of the requesting device (that is, the switch in this context).

  By default, the switch also fills in the Option 82 circuit-id field with information indicating the local interface over which the switch received the DHCP client request, including the port and VLAN ID. This allows DHCP client-server exchange messages to be forwarded between the server and client without having to flood them to the entire VLAN.
- If DHCP Snooping Information Option 82 is enabled on the switch, information may be inserted into a DHCP request packet received over any VLAN (depending on DHCP snooping filtering rules). The information inserted into the relayed packets includes the circuit-id and remote-id, as well as the gateway Internet address.
- When the switch receives DHCP packets from clients that already include DHCP Option 82 information, the switch can be configured to set the action policy for these packets. The switch can either drop the DHCP packets, keep the existing information, or replace it with the switch's relay information.

DHCP Snooping Configuration

Use the IP SERVICE > DHCP > SNOOPING (CONFIGURE GLOBAL) page to enable DHCP Snooping globally on the switch, or to configure MAC Address Verification.

CLI References

See Section 14-13: "DHCP Snooping" on page 14-89 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **DHCP Snooping Status –** Enables DHCP snooping globally. (Default: Disabled)
- **DHCP Snooping MAC-Address Verification** – Enables or disables MAC address verification. If the source MAC address in the Ethernet header of the packet is not same as the client's hardware address in the DHCP packet, the packet is dropped. (Default: Enabled)
- **DHCP Snooping Information Option Status** – Enables or disables DHCP Option 82 information relay. (Default: Disabled)
- **DHCP Snooping Information Option Policy** – Specifies how to handle DHCP client request packets which already contain Option 82 information.
  - **Drop** – Drops the client's request packet instead of relaying it.
  - **Keep** – Retains the Option 82 information in the client request, and forwards the packets to trusted ports.

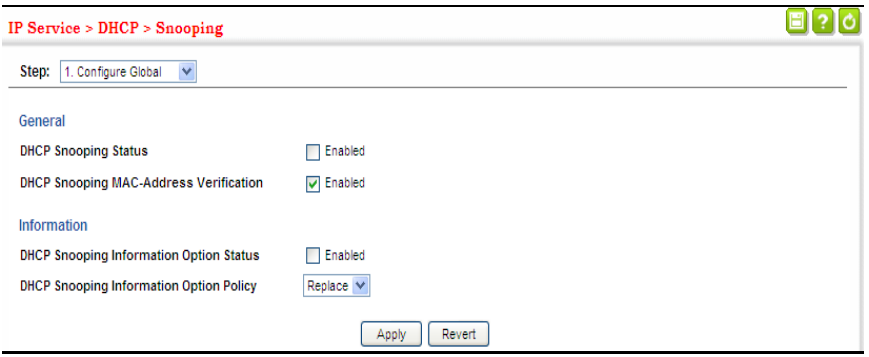
- **Replace** – Replaces the Option 82 information circuit-id and remote-id fields in the client's request with information about the relay agent itself, inserts the relay agent's address (when DHCP snooping is enabled), and forwards the packets to trusted ports. (This is the default policy.)

Web Interface

To configure global settings for DHCP Snooping:

1. Click IP SERVICE > DHCP > SNOOPING.
2. Select CONFIGURE GLOBAL from the Step list.
3. Select the required options for the general DHCP snooping process and for the DHCP Option 82 information policy.
4. Click APPLY

Figure 14-64. Configuring Global Settings for DHCP Snooping



DHCP Snooping VLAN Configuration

Use the IP SERVICE > DHCP > SNOOPING (CONFIGURE VLAN) page to enable or disable DHCP snooping on specific VLANs.

CLI References

See "ip dhcp snooping vlan" on page 25-34 for CLI reference information.

Command Usage

- When DHCP snooping is enabled globally on the switch, and enabled on the specified VLAN, DHCP packet filtering will be performed on any untrusted ports within the VLAN.

- When the DHCP snooping is globally disabled, DHCP snooping can still be configured for specific VLANs, but the changes will not take effect until DHCP snooping is globally re-enabled.
- When DHCP snooping is globally enabled, and DHCP snooping is then disabled on a VLAN, all dynamic bindings learned for this VLAN are removed from the binding table.

Parameters

These parameters are displayed in the web interface:

- **VLAN** – ID of a configured VLAN. (Range: 1-4093)
- **DHCP Snooping Status** – Enables or disables DHCP snooping for the selected VLAN. When DHCP snooping is enabled globally on the switch, and enabled on the specified VLAN, DHCP packet filtering will be performed on any untrusted ports within the VLAN. (Default: Disabled)

Web Interface

To configure global settings for DHCP Snooping:

1. Click SECURITY > DHCP SNOOPING.
2. Select CONFIGURE VLAN from the Step list.
3. Enable DHCP Snooping on any existing VLAN.
4. Click APPLY

Figure 14-65. Configuring DHCP Snooping on a VLAN

CONFIGURING PORTS FOR DHCP SNOOPING

Use the IP SERVICE > DHCP > SNOOPING (CONFIGURE INTERFACE) page to configure switch ports as trusted or untrusted.

CLI References

See "ip dhcp snooping trust" on page 25-35 for CLI reference information.

Command Usage

- A trusted interface is an interface that is configured to receive only messages from within the network. An untrusted interface is an interface that is configured to receive messages from outside the network or fire wall.
- When DHCP snooping is enabled both globally and on a VLAN, DHCP packet filtering will be performed on any untrusted ports within the VLAN.
- When an untrusted port is changed to a trusted port, all the dynamic DHCP snooping bindings associated with this port are removed.
- Set all ports connected to DHCP servers within the local network or fire wall to trusted state. Set all other ports outside the local network or fire wall to untrusted state.

Parameters

These parameters are displayed in the web interface:

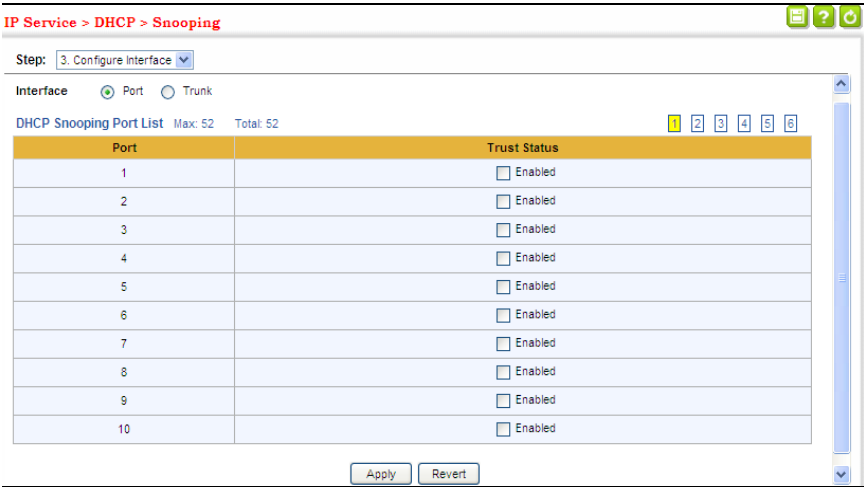
- **Trust Status** – Enables or disables a port as trusted. (Default: Disabled)

Web Interface

To configure global settings for DHCP Snooping:

1. Click SECURITY > DHCP SNOOPING.
2. Select CONFIGURE INTERFACE from the Step list.
3. Set any ports within the local network or firewall to trusted.
4. Click APPLY

Figure 14-66. Configuring the Port Mode for DHCP Snooping



Displaying DHCP Snooping Binding Information

Use the IP SERVICE > DHCP > SNOOPING (SHOW INFORMATION) page to display entries in the binding table.

CLI References

See "show ip dhcp snooping binding" on page 25-37 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **MAC Address** – Physical address associated with the entry.
- **IP Address** – IP address corresponding to the client.
- **Lease Time (seconds)** – The time for which this IP address is leased to the client.
- **Type** – Entry types include:
  - **DHCP-Snooping** – Dynamically snooped.
  - **Static-DHCPSNP** – Statically configured.
- **VLAN** – VLAN to which this entry is bound.
- **Interface** – Port or trunk to which this entry is bound.

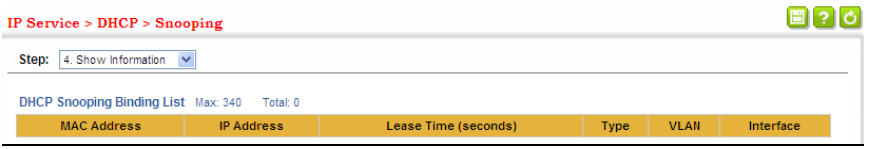
- **Store** – Writes all dynamically learned snooping entries to flash memory. This function can be used to store the currently learned dynamic DHCP snooping entries to flash memory. These entries will be restored to the snooping table when the switch is reset. However, note that the lease time shown for a dynamic entry that has been restored from flash memory will no longer be valid.
- **Clear** – Removes all dynamically learned snooping entries from flash memory.

Web Interface

To display the binding table for DHCP Snooping:

1. Click SECURITY > DHCP SNOOPING.
2. Select SHOW INFORMATION from the Step list.
3. Use the STORE or CLEAR function if required.

Figure 14-67. Displaying the Binding Table for DHCP Snooping



Chapter 15
Basic Administration Protocols

This chapter describes basic administration tasks including:

- Configuring Event Logging – Sets conditions for logging event messages to system memory or flash memory, configures conditions for sending trap messages to remote log servers, and configures trap reporting to remote hosts using Simple Mail Transfer Protocol (SMTP).
- Link Layer Discovery Protocol – Configures advertisement of basic information about the local switch, or discovery of information about neighboring devices on the local broadcast domain.
- Power Over Ethernet – Sets the priority and power budget for each port.
- Simple Network Management Protocol – Configures switch management through SNMPv1, SNMPv2c or SNMPv3.
- Remote Monitoring – Configures local collection of detailed statistics or events which can be subsequently retrieved through SNMP.
- Switch Clustering – Configures centralized management by a single unit over a group of switches connected to the same local network
- Setting A Time Range – Sets a time range during which various functions are applied, including applied ACLs or PoE

15-1 Configuring Event Logging

The switch allows you to control the logging of error messages, including the type of events that are recorded in switch memory, logging to a remote System Log (syslog) server, and displays a list of recent event messages.

System Log Configuration

Use the ADMINISTRATION > LOG > SYSTEM (CONFIGURE GLOBAL) page to enable or disable event logging, and specify which levels are logged to RAM or flash memory.

Severe error messages that are logged to flash memory are permanently stored in the switch to assist in troubleshooting network problems. Up to 4096 log entries can be stored in the flash memory, with the oldest entries being overwritten first when the available log memory (256 kilobytes) has been exceeded.

The System Logs page allows you to configure and limit system messages that are logged to flash or RAM memory. The default is for event levels 0 to 3 to be logged to flash and levels 0 to 7 to be logged to RAM.

CLI References

See Section 21-6: "Event Logging" on page 21-37 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **System Log Status** – Enables/disables the logging of debug or error messages to the logging process. (Default: Enabled)
- **Flash Level** – Limits log messages saved to the switch's permanent flash memory for all levels up to the specified level. For example, if level 3 is specified, all messages from level 0 to level 3 will be logged to flash. (Range: 0-7, Default: 3)

Table 15-1. Logging Levels

Level	Severity Name	Description
7[a]	Debug	Debugging messages
6	Informational	Informational messages only
5	Notice	Normal but significant condition, such as cold start
4	Warning	Warning conditions (e.g., return false, unexpected return)
3	Error	Error conditions (e.g., invalid input, default used)
2	Critical	Critical conditions (e.g., memory allocation, or free memory error - resource exhausted)
1	Alert	Immediate action needed
0	Emergency	System unusable

a. There are only Level 2, 5 and 6 error messages for the current firmware release.

- **RAM Level** – Limits log messages saved to the switch's temporary RAM memory for all levels up to the specified level. For example, if level 7 is specified, all messages from level 0 to level 7 will be logged to RAM. (Range: 0-7, Default: 7)

NOTE: The Flash Level must be equal to or less than the RAM Level.

NOTE: All log messages are retained in RAM and Flash after a warm restart (i.e., power is reset through the command interface).

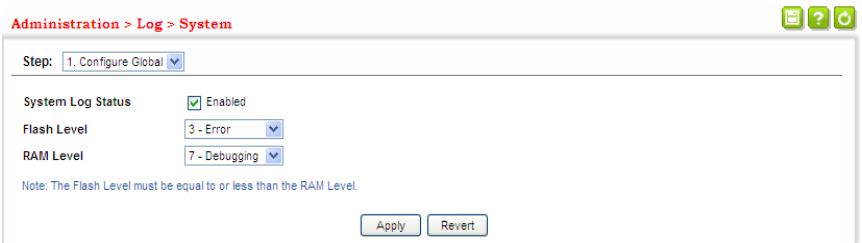
NOTE: All log messages are retained in Flash and purged from RAM after a cold restart (i.e., power is turned off and then on through the power source).

Web Interface

To configure the logging of error messages to system memory:

1. Click ADMINISTRATION > LOG > SYSTEM.
2. Select CONFIGURE GLOBAL from the STEP list.
3. Enable or disable system logging, set the level of event messages to be logged to flash memory and RAM.
4. Click APPLY.

Figure 15-1. Configuring Settings for System Memory Logs

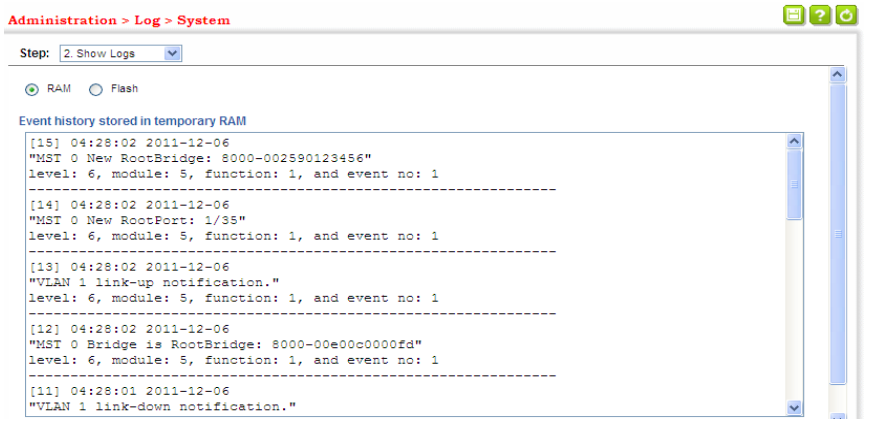


To show the error messages logged to system or flash memory:

1. Click ADMINISTRATION > LOG > SYSTEM.
2. Select SHOW LOGS from the STEP list.
3. Click RAM to display log messages stored in system memory, or FLASH to display messages stored in flash memory.

   This page allows you to scroll through the logged system and event messages. The switch can store up to 2048 log entries in temporary random access memory (RAM; i.e., memory flushed on power reset) and up to 4096 entries in permanent flash memory.

Figure 15-2. Showing Error Messages Logged to System Memory


Administration > Log > System
Step: 2. Show Logs
RAM
Flash
Event history stored in temporary RAM
[15] 04:28:02 2011-12-06
"MST 0 New RootBridge: 8000-002590123456"
level: 6, module: 5, function: 1, and event no: 1
[14] 04:28:02 2011-12-06
"MST 0 New RootPort: 1/35"
level: 6, module: 5, function: 1, and event no: 1
[13] 04:28:02 2011-12-06
"VLAN 1 link-up notification."
level: 6, module: 5, function: 1, and event no: 1
[12] 04:28:02 2011-12-06
"MST 0 Bridge is RootBridge: 8000-00e00c0000fd"
level: 6, module: 5, function: 1, and event no: 1
[11] 04:28:01 2011-12-06
"VLAN 1 link-down notification."

Remote Log Configuration

Use the ADMINISTRATION > LOG > REMOTE page to send log messages to syslog servers or other management stations. You can also limit the event messages sent to only those messages below a specified level.

CLI References

See Section 21-6: "Event Logging" on page 21-37 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Remote Log Status** – Enables/disables the logging of debug or error messages to the remote logging process. (Default: Disabled)
- **Logging Facility** – Sets the facility type for remote logging of syslog messages. There are eight facility types specified by values of 16 to 23. The facility type is used by the syslog server to dispatch log messages to an appropriate service.

  The attribute specifies the facility type tag sent in syslog messages (see RFC 3164). This type has no effect on the kind of messages reported by the switch. However, it may be used by the syslog server to process messages, such as sorting or storing messages in the corresponding database. (Range: 16-23, Default: 23)
- **Logging Trap Level** – Limits log messages that are sent to the remote syslog server for all levels up to the specified level. For example, if level 3 is specified, all messages from level 0 to level 3 will be sent to the remote server. (Range: 0-7, Default: 7)

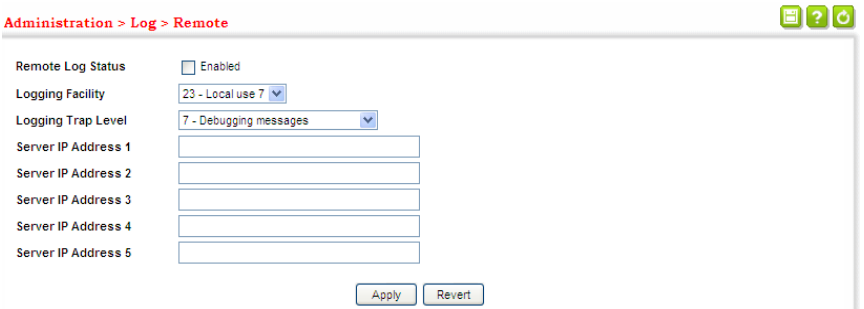
- **Server IP Address** – Specifies the IP address of a remote server which will be sent syslog messages.

Web Interface

To configure the logging of error messages to remote servers:

1. Click ADMINISTRATION > LOG > REMOTE.
2. Enable remote logging, specify the facility type to use for the syslog messages. and enter the IP address of the remote servers.
3. Click APPLY.

Figure 15-3. Configuring Settings for Remote Logging of Error Messages



Sending Simple Mail Transfer Protocol Alerts

Use the ADMINISTRATION > LOG > SMTP (CONFIGURE GENERAL AND CONFIGURE SERVER) pages to alert system administrators of problems by sending SMTP (Simple Mail Transfer Protocol) email messages when triggered by logging events of a specified level. The messages are sent to specified SMTP servers on the network and can be retrieved using POP or IMAP clients.

CLI References

See Section 21-7: "SMTP Alerts" on page 21-46 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Configure General

- **SMTP Status** – Enables/disables the SMTP function. (Default: Enabled)

- **Severity** – Sets the syslog severity threshold level (see Table 15-1: "Logging Levels" on page 15-2) used to trigger alert messages. All events at this level or higher will be sent to the configured email recipients. For example, using Level 7 will report all events from level 7 to level 0. (Default: Level 7)
- **Email Source Address** – Sets the email address used for the "From" field in alert messages. You may use a symbolic email address that identifies the switch, or the address of an administrator responsible for the switch.
- **Email Destination Address** – Specifies the email recipients of alert messages. You can specify up to five recipients.

Configure Server

- **Host Name/IP Address** – Specifies a recipient SMTP server. (Up to three servers may be specified.) The switch attempts to connect to the listed servers in sequential order if the first server fails to respond.

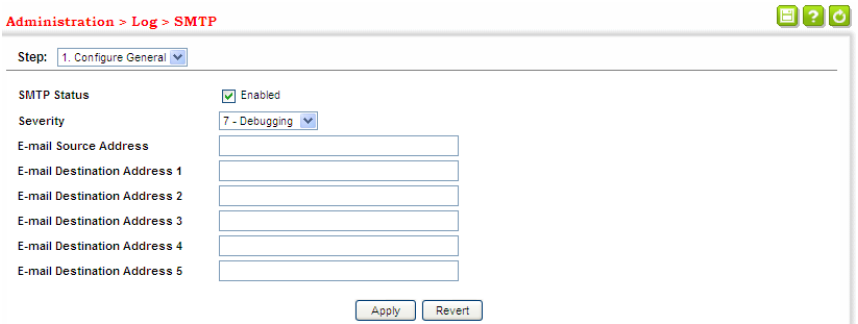
  For host name-to-IP address translation to function properly, host name lookup must be enabled (Section 17-1: "Configuring General DNS Service Parameters" on page 17-1), and one or more DNS servers specified (see Section 17-3: "Configuring a List of Name Servers" on page 17-4, or Section 17-4: "Configuring Static DNS Host to Address Entries" on page 17-5).
- **Authentication** – Enables or disables user authentication.
- **User Name** – Name of SMTP server user. (Range: 1-8 characters)
- **Password** – Password of SMTP server user. (Range: 1-8 characters)
- **Authentication Method** – Indicates that Base 64 encoding is used.

Web Interface

To configure general settings for SMTP alert messages:

1. Click ADMINISTRATION > LOG > SMTP.
2. Select CONFIGURE GENERAL from the STEP list.
3. Enable SMTP, specify a source email address, and select the minimum severity level. Specify the source and destination email addresses.
4. Click APPLY.

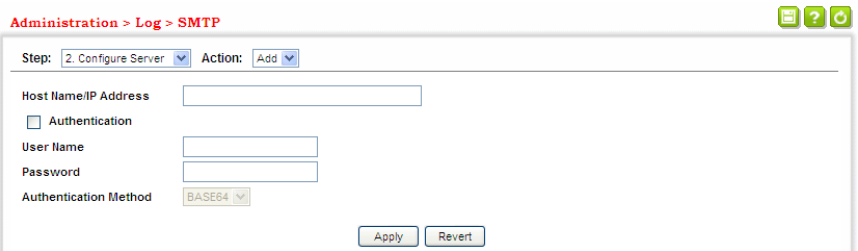
Figure 15-4. Configuring General Settings for SMTP Alert Messages



To specify SMTP servers:

1. Click ADMINISTRATION > LOG > SMTP.
2. Select CONFIGURE SERVER from the STEP list.
3. Select ADD from the ACTION list.
4. Specify the host name or IP address of an SMTP server. If authentication is enabled, specify the name and password for a user configured on the SMTP server.
5. Click APPLY.

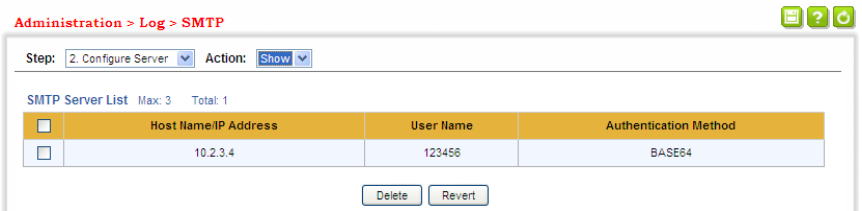
Figure 15-5. Specifying SMTP Servers



To show a list of configured SMTP servers:

1. Click ADMINISTRATION > LOG > SMTP.
2. Select CONFIGURE SERVER from the STEP list.
3. Select SHOW from the ACTION list.

Figure 15-6. Showing Configured SMTP Servers



15-2 Link Layer Discovery Protocol

Link Layer Discovery Protocol (LLDP) is used to discover basic information about neighboring devices on the local broadcast domain. LLDP is a Layer 2 protocol that uses periodic broadcasts to advertise information about the sending device. Advertised information is represented in Type Length Value (TLV) format according to the IEEE 802.1ab standard, and can include details such as device identification, capabilities and configuration settings. LLDP also defines how to store and maintain information gathered about the neighboring network nodes it discovers.

Link Layer Discovery Protocol - Media Endpoint Discovery (LLDP-MED) is an extension of LLDP intended for managing endpoint devices such as Voice over IP phones and network switches. The LLDP-MED TLVs advertise information such as network policy, power, inventory, and device location details. LLDP and LLDP-MED information can be used by SNMP applications to simplify troubleshooting, enhance network management, and maintain an accurate network topology.

Setting LLDP Timing Attributes

Use the ADMINISTRATION > LLDP (CONFIGURE GLOBAL) page to set attributes for general functions such as globally enabling LLDP on the switch, setting the message ageout time, and setting the frequency for broadcasting general advertisements or reports about changes in the LLDP MIB.

CLI References

See Chapter 39: "LLDP Commands" on page 39-1 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **LLDP** – Enables LLDP globally on the switch. (Default: Enabled)
- **Transmission Interval** – Configures the periodic transmit interval for LLDP advertisements. (Range: 5-32768 seconds; Default: 30 seconds)

- **Hold Time Multiplier** – Configures the time-to-live (TTL) value sent in LLDP advertisements as shown in the formula below. (Range: 2-10; Default: 4)

  The time-to-live tells the receiving LLDP agent how long to retain all information pertaining to the sending LLDP agent if it does not transmit updates in a timely manner.

  TTL in seconds is based on the following rule:
  minimum value ((Transmission Interval * Holdtime Multiplier), or 65536)

  Therefore, the default TTL is 4*30 = 120 seconds.

- **Delay Interval** – Configures a delay between the successive transmission of advertisements initiated by a change in local LLDP MIB variables. (Range: 1-8192 seconds; Default: 2 seconds)

  The transmit delay is used to prevent a series of successive LLDP transmissions during a short period of rapid changes in local LLDP MIB objects, and to increase the probability that multiple, rather than single changes, are reported in each transmission.

  This attribute must comply with the rule:
  (4 * Delay Interval) ≤ Transmission Interval

- **Reinitialization Delay** – Configures the delay before attempting to re-initialize after LLDP ports are disabled or the link goes down. (Range: 1-10 seconds; Default: 2 seconds)

  When LLDP is re-initialized on a port, all information in the remote systems LLDP MIB associated with this port is deleted.

- **Notification Interval** – Configures the allowed interval for sending SNMP notifications about LLDP MIB changes. (Range: 5-3600 seconds; Default: 5 seconds)

  This parameter only applies to SNMP applications which use data stored in the LLDP MIB for network monitoring or management.

  Information about changes in LLDP neighbors that occur between SNMP notifications is not transmitted. Only state changes that exist at the time of a notification are included in the transmission. An SNMP agent should therefore periodically check the value of lldpStatsRemTableLastChangeTime to detect any lldpRemTablesChange notification-events missed due to throttling or transmission loss.

- **MED Fast Start Count** – Configures the amount of LLDP MED Fast Start LLDPDUs to transmit during the activation process of the LLDP-MED Fast Start mechanism. (Range: 1-10 packets; Default: 4 packets)

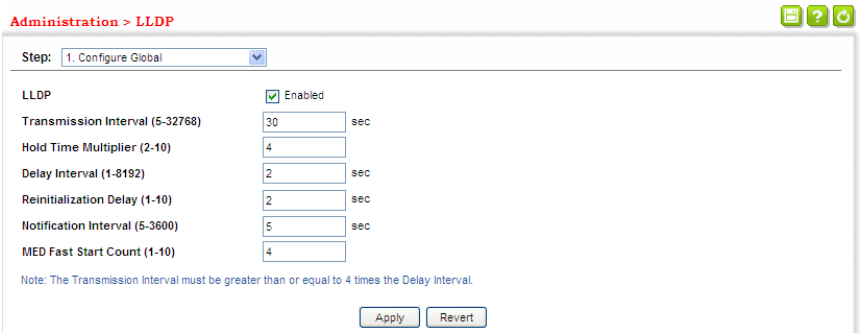
  The MED Fast Start Count parameter is part of the timer which ensures that the LLDP-MED Fast Start mechanism is active for the port. LLDP-MED Fast Start is critical to the timely startup of LLDP, and therefore integral to the rapid availability of Emergency Call Service.

Web Interface

To configure LLDP timing attributes:

1. Click ADMINISTRATION > LLDP.
2. Select CONFIGURE GLOBAL from the STEP list.
3. Enable LLDP, and modify any of the timing parameters as required.
4. Click APPLY.

Figure 15-7. Configuring LLDP Timing Attributes



Configuring LLDP Interface Attributes

Use the ADMINISTRATION > LLDP (CONFIGURE INTERFACE – CONFIGURE GENERAL) page to specify the message attributes for individual interfaces, including whether messages are transmitted, received, or both transmitted and received, whether SNMP notifications are sent, and the type of information advertised.

CLI References

See Chapter 39: "LLDP Commands" on page 39-1 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Admin Status** – Enables LLDP message transmit and receive modes for LLDP Protocol Data Units. (Options: Tx only, Rx only, TxRx, Disabled; Default: TxRx)
- **SNMP Notification** – Enables the transmission of SNMP trap notifications about LLDP and LLDP-MED changes. (Default: Disabled)

This option sends out SNMP trap notifications to designated target stations at the interval specified by the Notification Interval in the preceding section. Trap notifications include information about state changes in the LLDP MIB (IEEE 802.1AB), the LLDP-MED MIB (ANSI/TIA-1057), or vendor-specific LLDP-EXT-DOT1 and LLDP-EXT-DOT3 MIBs.

For information on defining SNMP trap destinations, see "Specifying Notification Managers" on page 15-49.

Information about additional changes in LLDP neighbors that occur between SNMP notifications is not transmitted. Only state changes that exist at the time of a trap notification are included in the transmission. An SNMP agent should therefore periodically check the value of lldpStatsRemTableLastChangeTime to detect any lldpRemTablesChange notification-events missed due to throttling or transmission loss.

- **MED Notification** – Enables the transmission of SNMP trap notifications about LLDP-MED changes. (Default: Enabled)
- **Basic Optional TLVs** – Configures basic information included in the TLV field of advertised messages.
  - **Management Address** – The management address protocol packet includes the IPv4 address of the switch. If no management address is available, the address should be the MAC address for the CPU or for the port sending this advertisement.

    The management address TLV may also include information about the specific interface associated with this address, and an object identifier indicating the type of hardware component or protocol entity associated with this address. The interface number and OID are included to assist SNMP applications in the performance of network discovery by indicating enterprise specific or other starting points for the search, such as the Interface or Entity MIB.

    Since there are typically a number of different addresses associated with a Layer 3 device, an individual LLDP PDU may contain more than one management address TLV.

    Every management address TLV that reports an address that is accessible on a port and protocol VLAN through the particular port should be accompanied by a port and protocol VLAN TLV that indicates the VLAN identifier (VID) associated with the management address reported by this TLV.
  - **Port Description** – The port description is taken from the ifDescr object in RFC 2863, which includes information about the manufacturer, the product name, and the version of the interface hardware/software.
  - **System Capabilities** – The system capabilities identifies the primary function(s) of the system and whether or not these primary functions are enabled. The information advertised by this TLV is described in IEEE 802.1AB.

- **System Description** – The system description is taken from the sysDescr object in RFC 3418, which includes the full name and version identification of the system's hardware type, software operating system, and networking software.
- **System Name** – The system name is taken from the sysName object in RFC 3418, which contains the system's administratively assigned name. To configure the system name, see Section 5-1: "Displaying System Information" on page 5-1.

- **802.1 Organizationally Specific TLVs** – Configures IEEE 802.1 information included in the TLV field of advertised messages.
  - **Protocol Identity** – The protocols that are accessible through this interface (see Section 7-3: "Protocol VLANs" on page 7-19).
  - **VLAN ID** – The port's default VLAN identifier (PVID) indicates the VLAN with which untagged or priority-tagged frames are associated (see Section 7-1: "IEEE 802.1Q VLANs" on page 7-1).
  - **VLAN Name** – The name of all VLANs to which this interface has been assigned (see Section 7-1: "IEEE 802.1Q VLANs" on page 7-1 and Section 7-3: "Protocol VLANs" on page 7-19).
  - **Port and Protocol VLAN ID** – The port-based protocol VLANs configured on this interface (see Section 7-1: "IEEE 802.1Q VLANs" on page 7-1 and Section 7-3: "Protocol VLANs" on page 7-19).
- **802.3 Organizationally Specific TLVs** – Configures IEEE 802.3 information included in the TLV field of advertised messages.
  - **Link Aggregation** – The link aggregation capabilities, aggregation status of the link, and the IEEE 802.3 aggregated port identifier if this interface is currently a link aggregation member.
  - **Max Frame Size** – The maximum frame size. (See Section 5-3: "Configuring Support for Jumbo Frames" on page 5-3 for information on configuring the maximum frame size for this switch
  - **MAC/PHY Configuration/Status** – The MAC/PHY configuration and status which includes information about auto-negotiation support/capabilities, and operational Multistation Access Unit (MAU) type.
  - **PoE** – Power-over-Ethernet capabilities, including whether or not PoE is supported, currently enabled, if the port pins through which power is delivered can be controlled, the port pins selected to deliver power, and the power class.
- **MED TLVs** – Configures general information included in the MED TLV field of advertised messages.
  - **Capabilities** – This option advertises LLDP-MED TLV capabilities, allowing Media Endpoint and Connectivity Devices to efficiently discover which LLDP-MED related TLVs are supported on the switch.

- **Extended Power** – This option advertises extended Power-over-Ethernet capability details, such as power availability from the switch, and power state of the switch, including whether the switch is operating from primary or backup power (the Endpoint Device could use this information to decide to enter power conservation mode). Note that this device does not support PoE capabilities.
- **Inventory** – This option advertises device details useful for inventory management, such as manufacturer, model, software version and other pertinent information.
- **Location** – This option advertises location identification details.
- **Network Policy** – This option advertises network policy configuration information, aiding in the discovery and diagnosis of VLAN configuration mismatches on a port. Improper network policy configurations frequently result in voice quality degradation or complete service disruption.

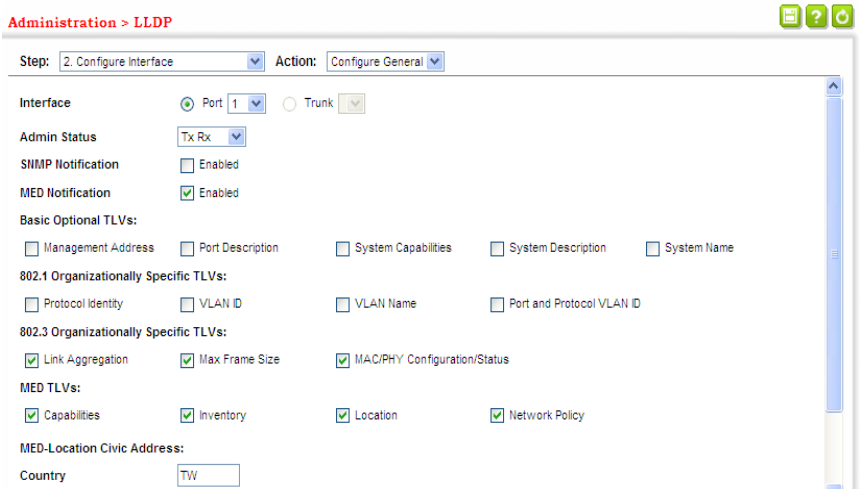
- MED-Location Civic Address – Configures information for the location of the attached device included in the MED TLV field of advertised messages, including the country and the device type.
  - **Country** – The two-letter ISO 3166 country code in capital ASCII letters. (Example: DK, DE or US)
  - **Device entry refers to** – The type of device to which the location applies:
    - Location of DHCP server.
    - Location of network element closest to client.
    - Location of client. (This is the default.)

Web Interface

To configure LLDP interface attributes:

1. Click ADMINISTRATION > LLDP.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select CONFIGURE GENERAL from the ACTION list.
4. Select an interface from the PORT or TRUNK list.
5. Set the LLDP transmit/receive mode, specify whether or not to send SNMP trap messages, and select the information to advertise in LLDP messages.
6. Click APPLY.

Figure 15-8. Configuring LLDP Interface Attributes



Configuring LLDP Interface Civic-Address

Use the ADMINISTRATION > LLDP (CONFIGURE INTERFACE – ADD CA-TYPE) page to specify the physical location of the device attached to an interface.

CLI References

See "lldp med-location civic-addr" on page 39-16 for CLI reference information.

Command Usage

- Use the Civic Address type (CA-Type) to advertise the physical location of the device attached to an interface, including items such as the city, street number, building and room information. The address location is specified as a type and value pair, with the civic address type defined in RFC 4776. The following table describes some of the CA type numbers and provides examples.

Table 15-2. LLDP MED Location CA Types

CA Type	Description	CA Value Example
1	National subdivisions (state, canton, province)	California
2	County, parish	Orange
3	City, township	Irvine
4	City division, borough, city district	West Irvine
5	Neighborhood, block	Riverside

Table 15-2. LLDP MED Location CA Types (Continued)

CA Type	Description	CA Value Example
6	Group of streets below the neighborhood level	Exchange
18	Street suffix or type	Avenue
19	House number	320
20	House number suffix	A
21	Landmark or vanity address	Tech Center
26	Unit (apartment, suite)	Apt 519
27	Floor	5
28	Room	509B

- Any number of CA type and value pairs can be specified for the civic address location, as long as the total does not exceed 250 characters.

Parameters

These parameters are displayed in the web interface:

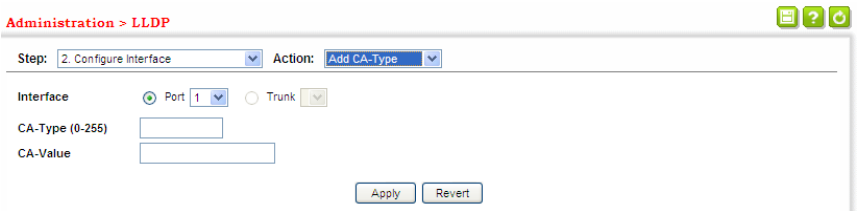
- **CA-Type** – Descriptor of the data civic address value. (Range: 0-255)
- **CA-Value** – Description of a location. (Range: 1-32 characters)

Web Interface

To specify the physical location of the attached device:

1. Click ADMINISTRATION > LLDP.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select ADD CA-TYPE from the ACTION list.
4. Select an interface from the PORT or TRUNK list.
5. Specify a CA-TYPE and CA-VALUE pair.
6. Click APPLY.

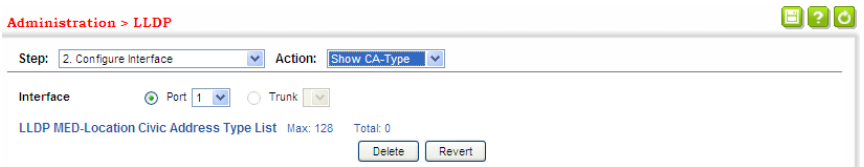
Figure 15-9. Configuring the Civic Address for an LLDP Interface



To show the physical location of the attached device:

1. Click ADMINISTRATION > LLDP.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select SHOW CA-TYPE from the ACTION list.
4. Select an interface from the PORT or TRUNK list.

Figure 15-10. Showing the Civic Address for an LLDP Interface



Displaying LLDP Local Device Information

Use the ADMINISTRATION > LLDP (SHOW LOCAL DEVICE INFORMATION) page to display information about the switch, such as its MAC address, chassis ID, management IP address, and port information.

CLI References

See "show lldp info local-device" on page 39-24 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Global Settings

- **Chassis Type** – Identifies the chassis containing the IEEE 802 LAN entity associated with the transmitting LLDP agent. There are several ways in which a chassis may be identified and a chassis ID subtype is used to indicate the type of component being referenced by the chassis ID field.

Table 15-3. Chassis ID Subtype

ID Basis	Reference
Chassis component	EntPhysicalAlias when entPhysClass has a value of 'chassis(3)' (IETF RFC 2737)
Interface alias	IfAlias (IETF RFC 2863)
Port component	EntPhysicalAlias when entPhysicalClass has a value 'port(10)' or 'backplane(4)' (IETF RFC 2737)
MAC address	MAC address (IEEE Std 802-2001)
Network address	networkAddress

Table 15-3. Chassis ID Subtype

ID Basis	Reference
Interface name	ifName (IETF RFC 2863)
Locally assigned	locally assigned

- **Chassis ID** – An octet string indicating the specific identifier for the particular chassis in this system.
- **System Name** – A string that indicates the system's administratively assigned name (see Section 5-1: "Displaying System Information" on page 5-1).
- **System Description** – A textual description of the network entity. This field is also displayed by the *Show System* command.
- **System Capabilities Supported** – The capabilities that define the primary function(s) of the system.

Table 15-4. System Capabilities

ID Basis	Reference
Other	—
Repeater	IETF RFC 2108
Bridge	IETF RFC 2674
WLAN Access Point	IEEE 802.11 MIB
Router	IETF RFC 1812
Telephone	IETF RFC 2011
DOCSIS cable device	IETF RFC 2669 and IETF RFC 2670
End Station Only	IETF RFC 2011

- **System Capabilities Enabled** – The primary function(s) of the system which are currently enabled. Refer to the preceding table.
- **Management Address** – The management address protocol packet includes the IPv4 address of the switch. If no management address is available, the address should be the MAC address for the CPU or for the port sending this advertisement.

Interface Settings

The attributes listed below apply to both port and trunk interface types. When a trunk is listed, the descriptions apply to the first port of the trunk.

- **Port/Trunk Description** – A string that indicates the port or trunk description. If RFC 2863 is implemented, the ifDescr object should be used for this field.
- **Port/Trunk ID** – A string that contains the specific identifier for the port or trunk from which this LLDPDU was transmitted.

Web Interface

To display LLDP information for the local device:

1. Click ADMINISTRATION > LLDP.
2. Select SHOW LOCAL DEVICE Information from the STEP list.
3. Select GENERAL, PORT, or TRUNK.

Figure 15-11. Displaying Local Device Information for LLDP (General)

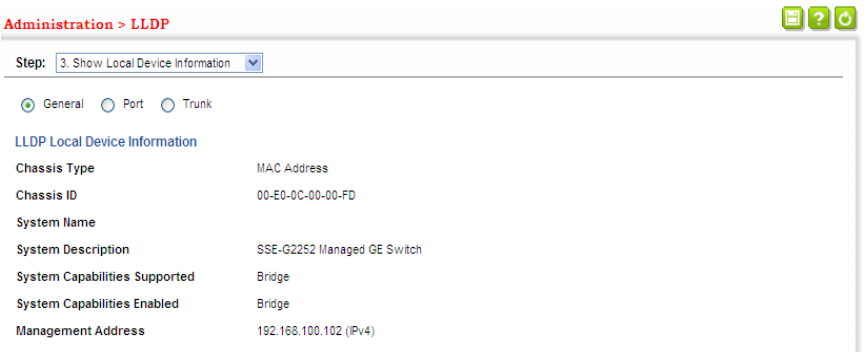
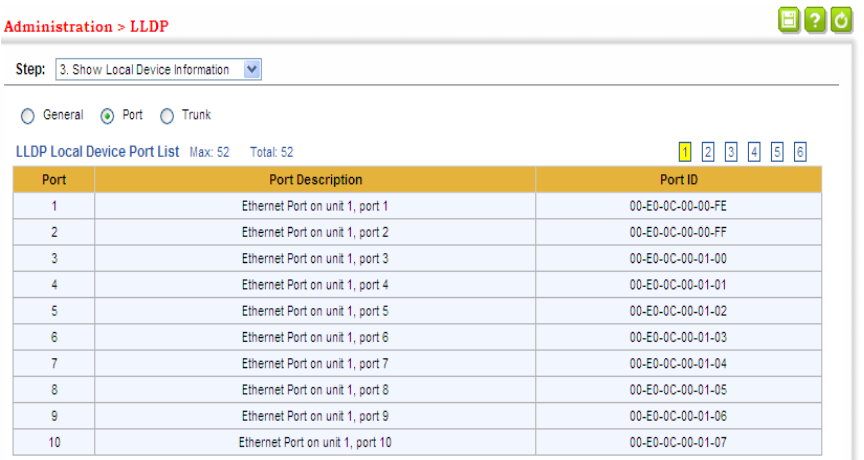


Figure 15-12. Displaying Local Device Information for LLDP (Port)



Port	Port Description	Port ID
1	Ethernet Port on unit 1, port 1	00-E0-0C-00-00-FE
2	Ethernet Port on unit 1, port 2	00-E0-0C-00-00-FF
3	Ethernet Port on unit 1, port 3	00-E0-0C-00-01-00
4	Ethernet Port on unit 1, port 4	00-E0-0C-00-01-01
5	Ethernet Port on unit 1, port 5	00-E0-0C-00-01-02
6	Ethernet Port on unit 1, port 6	00-E0-0C-00-01-03
7	Ethernet Port on unit 1, port 7	00-E0-0C-00-01-04
8	Ethernet Port on unit 1, port 8	00-E0-0C-00-01-05
9	Ethernet Port on unit 1, port 9	00-E0-0C-00-01-06
10	Ethernet Port on unit 1, port 10	00-E0-0C-00-01-07

Displaying LLDP Remote Port Information

Use the ADMINISTRATION > LLDP (SHOW REMOTE DEVICE INFORMATION) page to display information about devices connected directly to the switch's ports which are advertising information through LLDP, or to display detailed information about an LLDP-enabled device connected to a specific port on the local switch.

CLI References

See "show lldp info remote-device" on page 39-25 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Port

- **Local Port** – The local port to which a remote LLDP-capable device is attached.
- **Chassis ID** – An octet string indicating the specific identifier for the particular chassis in this system.
- **Port ID** – A string that contains the specific identifier for the port from which this LLDPDU was transmitted.
- **System Name** – A string that indicates the system's administratively assigned name.

Port Details

- **Local Port** – The local port to which a remote LLDP-capable device is attached.
- **Chassis Type** – Identifies the chassis containing the IEEE 802 LAN entity associated with the transmitting LLDP agent. There are several ways in which a chassis may be identified and a chassis ID subtype is used to indicate the type of component being referenced by the chassis ID field (see Table 15-3: "Chassis ID Subtype" on page 15-16).
- **Chassis ID** – An octet string indicating the specific identifier for the particular chassis in this system.
- **System Name** – A string that indicates the system's assigned name.
- **System Description** – A textual description of the network entity.
- **Port Type** – Indicates the basis for the identifier that is listed in the Port ID field.

Table 15-5. Port ID Subtype

ID Basis	Reference
Interface alias	IfAlias (IETF RFC 2863)
Chassis component	EntPhysicalAlias when entPhysClass has a value of 'chassis(3)' (IETF RFC 2737)

Table 15-5. Port ID Subtype (Continued)

ID Basis	Reference
Port component	EntPhysicalAlias when entPhysicalClass has a value 'port(10)' or 'backplane(4)' (IETF RFC 2737)
MAC address	MAC address (IEEE Std 802-2001)
Network address	networkAddress
Interface name	ifName (IETF RFC 2863)
Agent circuit ID	agent circuit ID (IETF RFC 3046)
Locally assigned	locally assigned

- **Port Description** – A string that indicates the port's description. If RFC 2863 is implemented, the ifDescr object should be used for this field.
- **Port ID** – A string that contains the specific identifier for the port from which this LLDPDU was transmitted.
- **System Capabilities Supported** – The capabilities that define the primary function(s) of the system (see Table 15-4: "System Capabilities" on page 15-17).
- **System Capabilities Enabled** – The primary function(s) of the system which are currently enabled (see Table 15-4: "System Capabilities" on page 15-17).
- **Management Address List** – The management addresses for this device. Since there are typically a number of different addresses associated with a Layer 3 device, an individual LLDP PDU may contain more than one management address TLV.

  If no management address is available, the address should be the MAC address for the CPU or for the port sending this advertisement.

Port Details – 802.1 Extension Information

- **Remote Port VID** – The port's default VLAN identifier (PVID) indicates the VLAN with which untagged or priority-tagged frames are associated.
- **Remote Port-Protocol VLAN List** – The port-based protocol VLANs configured on this interface, whether the given port (associated with the remote system) supports port-based protocol VLANs, and whether the port-based protocol VLANs are enabled on the given port associated with the remote system.
- **Remote VLAN Name List** – VLAN names associated with a port.
- **Remote Protocol Identity List** – Information about particular protocols that are accessible through a port. This object represents an arbitrary local integer value used by this agent to identify a particular protocol identity, and an octet string used to identify the protocols associated with a port of the remote system.

Port Details – 802.3 Extension Port Information

- **Remote Port Auto-Neg Supported** – Shows whether the given port (associated with remote system) supports auto-negotiation.

- **Remote Port Auto-Neg Adv-Capability** – The value (bitmap) of the ifMauAutoNegCapAdvertisedBits object (defined in IETF RFC 3636) which is associated with a port on the remote system.

Table 15-6. Remote Port Auto-Negotiation Advertised Capability

Bit	Capability
0	other or unknown
1	10BASE-T half duplex mode
2	10BASE-T full duplex mode
3	100BASE-T4
4	100BASE-TX half duplex mode
5	100BASE-TX full duplex mode
6	100BASE-T2 half duplex mode
7	100BASE-T2 full duplex mode
8	PAUSE for full-duplex links
9	Asymmetric PAUSE for full-duplex links
10	Symmetric PAUSE for full-duplex links
11	Asymmetric and Symmetric PAUSE for full-duplex links
12	1000BASE-X, -LX, -SX, -CX half duplex mode
13	1000BASE-X, -LX, -SX, -CX full duplex mode
14	1000BASE-T half duplex mode
15	1000BASE-T full duplex mode

- **Remote Port Auto-Neg Status** – Shows whether port auto-negotiation is enabled on a port associated with the remote system.
- **Remote Port MAU Type** – An integer value that indicates the operational MAU type of the sending device. This object contains the integer value derived from the list position of the corresponding dot3MauType as listed in IETF RFC 3636 and is equal to the last number in the respective dot3MauType OID.

Port Details – 802.3 Extension Power Information

- **Remote Power Class** – The port Class of the given port associated with the remote system (PSE – Power Sourcing Equipment or PD – Powered Device).
- **Remote Power MDI Status** – Shows whether MDI power is enabled on the given port associated with the remote system.
- **Remote Power Pairs** – “Signal” means that the signal pairs only are in use, and “Spare” means that the spare pairs only are in use.
- **Remote Power MDI Supported** – Shows whether MDI power is supported on the given port associated with the remote system.

- **Remote Power Pair Controlable** – Indicates whether the pair selection can be controlled for sourcing power on the given port associated with the remote system.
- **Remote Power Classification** – This classification is used to tag different terminals on the Power over LAN network according to their power consumption. Devices such as IP telephones, WLAN access points and others, will be classified according to their power requirements.

Port Details – 802.3 Extension Trunk Information

- **Remote Link Aggregation Capable** – Shows if the remote port is not in link aggregation state and/or it does not support link aggregation.
- **Remote Link Aggregation Status** – The current aggregation status of the link.
- **Remote Link Port ID** – This object contains the IEEE 802.3 aggregated port identifier, aAggPortID (IEEE 802.3-2002, 30.7.2.1.1), derived from the ifNumber of the ifIndex for the port component associated with the remote system. If the remote port is not in link aggregation state and/or it does not support link aggregation, this value should be zero.

Port Details – 802.3 Extension Frame Information

- **Remote Max Frame Size** – An integer value indicating the maximum supported frame size in octets on the port component associated with the remote system.

Web Interface

To display LLDP information for a remote port:

1. Click ADMINISTRATION > LLDP.
2. Select SHOW REMOTE DEVICE INFORMATION from the STEP list.
3. Select PORT, PORT DETAILS, TRUNK, or TRUNK DETAILS.

Figure 15-13. Displaying Remote Device Information for LLDP (Port)

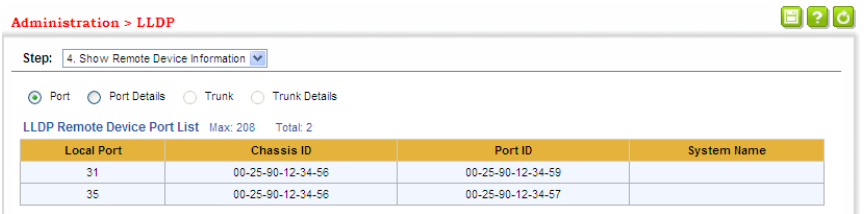
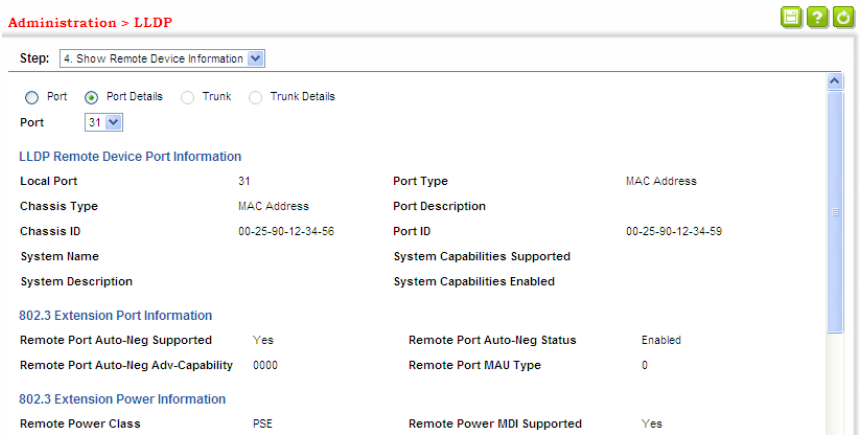


Figure 15-14. Displaying Remote Device Information for LLDP (Port Details)



Displaying Device Statistics

Use the ADMINISTRATION > LLDP (SHOW DEVICE STATISTICS) page to display statistics for LLDP-capable devices attached to the switch, and for LLDP protocol messages transmitted or received on all local interfaces.

CLI References

See "show lldp info statistics" on page 39-26 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

General Statistics on Remote Devices

- **Neighbor Entries List Last Updated** – The time the LLDP neighbor entry list was last updated.
- **New Neighbor Entries Count** – The number of LLDP neighbors for which the remote TTL has not yet expired.
- **Neighbor Entries Deleted Count** – The number of LLDP neighbors which have been removed from the LLDP remote systems MIB for any reason.
- **Neighbor Entries Dropped Count** – The number of times which the remote database on this switch dropped an LLDPDU because of insufficient resources.
- **Neighbor Entries Age-out Count** – The number of times that a neighbor's information has been deleted from the LLDP remote systems MIB because the remote TTL timer has expired.

Port/Trunk

- **Frames Discarded** – Number of frames discarded because they did not conform to the general validation rules as well as any specific usage rules defined for the particular TLV.
- **Frames Invalid** – A count of all LLDPDUs received with one or more detectable errors.
- **Frames Received** – Number of LLDP PDUs received.
- **Frames Sent** – Number of LLDP PDUs transmitted.
- **TLVs Unrecognized** – A count of all TLVs not recognized by the receiving LLDP local agent.
- **TLVs Discarded** – A count of all LLDPDUs received and then discarded due to insufficient memory space, missing or out-of-sequence attributes, or any other reason.
- **Neighbor Ageouts** – A count of the times that a neighbor's information has been deleted from the LLDP remote systems MIB because the remote TTL timer has expired.

Web Interface

To display statistics for LLDP-capable devices attached to the switch:

1. Click ADMINISTRATION > LLDP.
2. Select SHOW DEVICE STATISTICS from the STEP list.
3. Select GENERAL, PORT, or TRUNK.

Figure 15-15. Displaying LLDP Device Statistics (General)

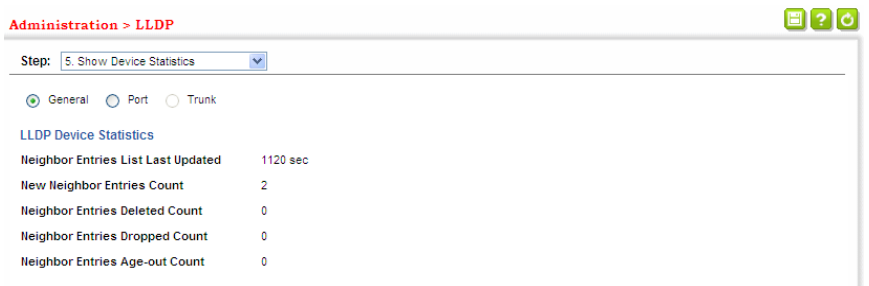
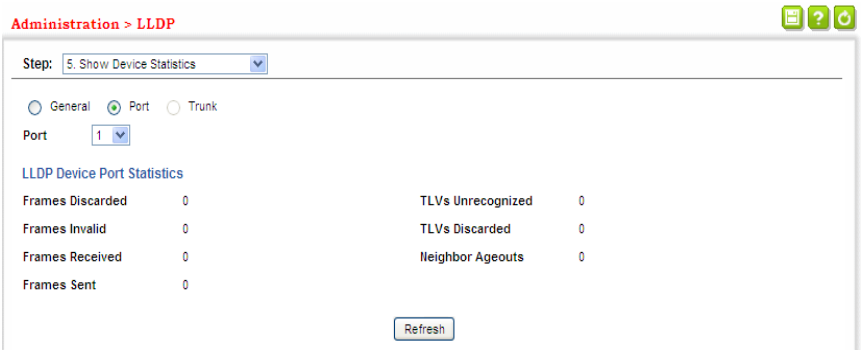


Figure 15-16. Displaying LLDP Device Statistics (Port)



15-3 Power Over Ethernet

Power over Ethernet (PoE) is a system for safely providing electrical power, along with data, over Ethernet cabling. IEEE standards 802.3af and 802.3at define the interfaces needed for providing up to 15.4 W (802.3af) or 25.5 W (802.3at) of DC power to compliant devices.

The SSE-G2252P switch complies with these standards and can provide DC power to a wide range of connected devices, eliminating the need for an additional power source and cutting down on the amount of cables attached to each device. Once configured to supply power, an automatic detection process is initialized by the switch that is authenticated by a PoE signature from the connected device. Detection and authentication prevent damage to non-compliant devices.

The switch's power management enables individual port power to be controlled within the switch's power budget. Port power can be automatically turned on and off for connected devices, and a per-port power priority can be set so that the switch never exceeds its power budget. When a device is connected to a switch port, its power requirements are detected by the switch before power is supplied. If the power required by a device exceeds the power budget of the port or the whole switch, power is not supplied.

Ports can be set to one of four power priority levels, critical, high, medium, or low. To control the power supply within the switch's budget, ports set at critical to medium priority have power enabled in preference to those ports set at low priority. For example, when a device connected to a port is set to critical priority, the switch supplies the required power, if necessary by denying power to ports set for a lower priority during bootup.

NOTE: For more information on using the PoE provided by this switch refer to the Installation Guide.

Displaying the Switch's Overall PoE Power Budget

Use the ADMINISTRATION > POE (CONFIGURE GLOBAL) page to display the maximum PoE power budget for the switch (power available to all RJ-45 ports). The maximum power budget is fixed at the maximum available setting, which prevents overload conditions at the power source. If the power demand from devices connected to the switch exceeds the power budget, the switch uses port power priority settings to limit the supplied power.

CLI References

See Chapter 29: "Power Over Ethernet Commands" on page 29-1 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

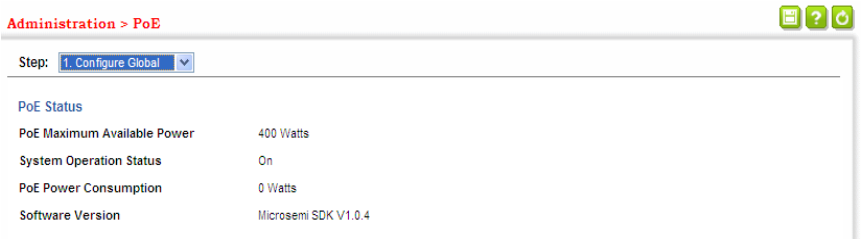
- **PoE Maximum Available Power** – The power budget for the switch. If devices connected to the switch require more power than the switch budget, the port power priority settings are used to control the supplied power. (Fixed: 400 Watts)
- **System Operation Status** – Status of the PoE power service provided to the switch ports.
- **PoE Power Consumption** – The amount of power being consumed by PoE devices connected to the switch.
- **Software Version** – The version of software running on the PoE controller subsystem in the switch.

Web Interface

To set the overall PoE power budget for switch:

1. Click ADMINISTRATION > POE.
2. Select CONFIGURE GLOBAL from the STEP list.

Figure 15-17. Showing the Switch's PoE Budget



Setting The Port PoE Power Budget

Use the ADMINISTRATION > POE (CONFIGURE INTERFACE) page to set the maximum power provided to a port.

CLI References

See Chapter 29: "Power Over Ethernet Commands" on page 29-1 and Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Command Usage

- This switch supports both the IEEE 802.3af PoE and IEEE 802.3at-2009 PoE Plus standards. To ensure that the correct power is supplied to powered devices (PD) compliant with these standards, the first detection pulse from the switch is based on 802.3af to which the 802.3af PDs will respond normally. It then sends a second PoE Plus pulse that causes an 802.3at PD to respond as a Class 4 device and draw Class 4 current. Afterwards, the switch exchanges information with the PD such as duty-cycle, peak and average power needs.
- All the RJ-45 ports support both the IEEE 802.3af and IEEE 802.3at standards. The total PoE power delivered by all ports cannot exceed the maximum power budget of 400W. This means that up to 11 ports can supply a maximum 34.2W of power simultaneously to connected devices (802.3at), up to 25 ports can supply up to 15.4W (802.3af), or all 48 ports can supply up to 7.5W (802.3af).
- If a device is connected to a switch port and the switch detects that it requires more than the power budget set for the port or to the overall switch, no power is supplied to the device (i.e., port power remains off).
- If the power demand from devices connected to all switch ports exceeds the power budget set for the switch, the port power priority settings are used to control the supplied power. For example:
    - If a device is connected to a low-priority port and causes the switch to exceed its budget, power to this port is not turned on.

- If a device is connected to a critical or high-priority port and would cause the switch to exceed its power budget as determined during bootup, power is provided to the port only if the switch can drop power to one or more lower-priority ports and thereby remain within its overall budget.
- If a device is connected to a port after the switch has finished booting up and would cause the switch to exceed its budget, power will not be provided to that port regardless of its priority setting.

NOTE: If priority is not set for any ports, and there is not sufficient power to supply all of the ports, power is denied sequentially to PSE chip sets 1-4:

PSE#1: 1,0,3,2,5,4,7,6,9,8,11,10
PSE#2: 13,12,15,14,17,16 19,18,21,20,23,22,25
PSE#3: 24,27,26,29,28,31,30,33,32,35,34,37
PSE#4: 36,39,38,41,40,43,42,45,44,47,46

Parameters

These parameters are displayed in the web interface:

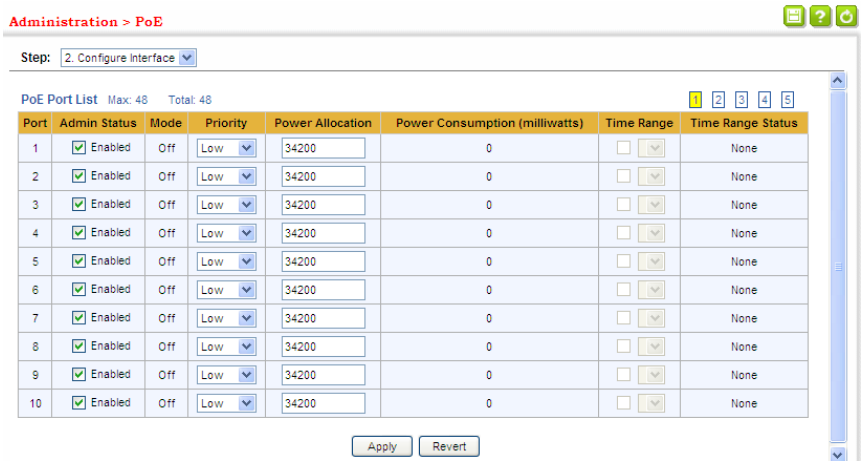
- **Port** – The port number on the switch.
- **Admin Status** – Enables PoE power on a port. Power is automatically supplied when a device is detected on a port, providing that the power demanded does not exceed the switch or port power budget. (Default: Enabled)
- **Mode** – Shows whether or not PoE power is being supplied to a port.
- **Priority** – Sets the power priority for a port. (Options: Low, High, or Critical; Default: Low)
- **Power Allocation** – Sets the power budget for a port.
- (Range: 3000-34200 milliwatts; Default: 34200 milliwatts)
- **Power Consumption** – Current power consumption on a port.
- **Time Range** – Name of a time range. If a time range is set, then PoE will be provided to an interface during the specified period.
- **Time Range Status** – Indicates if a time range has been applied to an interface, and whether it is currently active or inactive.

Web Interface

To set the PoE power budget for a port:

1. Click ADMINISTRATION > POE.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Enable PoE power on selected ports. Set the priority and the power budget. And specify a time range during which PoE will be provided to an interface.
4. Click APPLY.

Figure 15-18. Setting a Port's PoE Budget


Administration > PoE
Step: 2. Configure Interface
PoE Port List Max: 48 Total: 48
1 2 3 4 5
Port Admin Status Mode Priority Power Allocation Power Consumption (milliwatts) Time Range Time Range Status
1 Enabled Off Low 34200 0 None
2 Enabled Off Low 34200 0 None
3 Enabled Off Low 34200 0 None
4 Enabled Off Low 34200 0 None
5 Enabled Off Low 34200 0 None
6 Enabled Off Low 34200 0 None
7 Enabled Off Low 34200 0 None
8 Enabled Off Low 34200 0 None
9 Enabled Off Low 34200 0 None
10 Enabled Off Low 34200 0 None
Apply
Revert

15-4 Simple Network Management Protocol

Simple Network Management Protocol (SNMP) is a communication protocol designed specifically for managing devices on a network. Equipment commonly managed with SNMP includes switches, routers and host computers. SNMP is typically used to configure these devices for proper operation in a network environment, as well as to monitor them to evaluate performance or detect potential problems.

Managed devices supporting SNMP contain software, which runs locally on the device and is referred to as an agent. A defined set of variables, known as managed objects, is maintained by the SNMP agent and used to manage the device. These objects are defined in a Management Information Base (MIB) that provides a standard presentation of the information controlled by the agent. SNMP defines both the format of the MIB specifications and the protocol used to access this information over the network.

The switch includes an onboard agent that supports SNMP versions 1, 2c, and 3. This agent continuously monitors the status of the switch hardware, as well as the traffic passing through its ports. A network management station can access this information using network management software. Access to the onboard agent from clients using SNMP v1 and v2c is controlled by community strings. To communicate with the switch, the management station must first submit a valid community string for authentication.

Access to the switch from clients using SNMPv3 provides additional security features that cover message integrity, authentication, and encryption; as well as controlling user access to specific areas of the MIB tree.

The SNMPv3 security structure consists of security models, with each model having it's own security levels. There are three security models defined, SNMPv1, SNMPv2c, and SNMPv3. Users are assigned to "groups" that are defined by a security model and specified security levels. Each group also has a defined security access to set of MIB objects for reading and writing, which are known as "views." The switch has a default view (all MIB objects) and default groups defined for security models v1 and v2c. The following table shows the security models and levels available and the system default settings.

Table 15-7. SNMPv3 Security Models and Levels

Model	Level	Group	Read View	Write View	Notify View	Security
v1	noAuthNoPriv	public (read only)	defaultview	none	none	Community string only
v1	noAuthNoPriv	private (read/write)	defaultview	defaultview	none	Community string only
v1	noAuthNoPriv	user defined	user defined	user defined	user defined	Community string only
v2c	noAuthNoPriv	public (read only)	defaultview	none	none	Community string only
v2c	noAuthNoPriv	private (read/write)	defaultview	defaultview	none	Community string only
v2c	noAuthNoPriv	user defined	user defined	user defined	user defined	Community string only
v3	noAuthNoPriv	user defined	user defined	user defined	user defined	A user name match only
v3	AuthNoPriv	user defined	user defined	user defined	user defined	Provides user authentication via MD5 or SHA algorithms
v3	AuthPriv	user defined	user defined	user defined	user defined	Provides user authentication via MD5 or SHA algorithms and data privacy using DES 56-bit encryption

NOTE: The predefined default groups and view can be deleted from the system. You can then define customized groups and views for the SNMP clients that require access.

Command Usage

Configuring SNMPv1/2c Management Access

To configure SNMPv1 or v2c management access to the switch, follow these steps:

1. Use the ADMINISTRATION > SNMP (CONFIGURE GLOBAL) page to enable SNMP on the switch, and to enable trap messages.
2. Use the ADMINISTRATION > SNMP (CONFIGURE USER - ADD COMMUNITY) page to configure the community strings authorized for management access.
3. Use the ADMINISTRATION > SNMP (CONFIGURE TRAP) page to specify trap managers so that key events are reported by this switch to your management station.
4. Configuring SNMPv3 Management Access
5. Use the ADMINISTRATION > SNMP (CONFIGURE GLOBAL) page to enable SNMP on the switch, and to enable trap messages.
6. Use the ADMINISTRATION > SNMP (CONFIGURE TRAP) page to specify trap managers so that key events are reported by this switch to your management station.
7. Use the ADMINISTRATION > SNMP (CONFIGURE ENGINE) page to change the local engine ID. If you want to change the default engine ID, it must be changed before configuring other parameters.
8. Use the ADMINISTRATION > SNMP (CONFIGURE VIEW) page to specify read and write access views for the switch MIB tree.
9. Use the ADMINISTRATION > SNMP (CONFIGURE USER) page to configure SNMP user groups with the required security model (i.e., SNMP v1, v2c or v3) and security level (i.e., authentication and privacy).
10. Use the ADMINISTRATION > SNMP (CONFIGURE GROUP) page to assign SNMP users to groups, along with their specific authentication and privacy passwords.

Configuring Global Settings for SNMP

Use the ADMINISTRATION > SNMP (CONFIGURE GLOBAL) page to enable SNMPv3 service for all management clients (i.e., versions 1, 2c, 3), and to enable trap messages.

CLI References

See "snmp-server" on page 22-2 and "snmp-server enable traps" on page 22-7 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Agent Status** – Enables SNMP on the switch. (Default: Enabled)
- **Authentication Traps**[1] – Issues a trap message to specified IP trap managers whenever an invalid community string is submitted during the SNMP access authentication process. (Default: Enabled)
- **Link-up and Link-down Traps** – Issues a trap message whenever a port link is established or broken. (Default: Enabled)

Web Interface

To configure global settings for SNMP:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE GLOBAL from the STEP list.
3. Enable SNMP and the required trap types.
4. Click APPLY

Figure 15-19. Configuring Global Settings for SNMP

1. These are legacy notifications and therefore when used for SNMPv3 hosts, they must be enabled in conjunction with the corresponding entries in the Notification View (page 15-35).

Setting the Local Engine ID

Use the ADMINISTRATION > SNMP (CONFIGURE ENGINE - SET ENGINE ID) page to change the local engine ID. An SNMPv3 engine is an independent SNMP agent that resides on the switch. This engine protects against message replay, delay, and redirection. The engine ID is also used in combination with user passwords to generate the security keys for authenticating and encrypting SNMPv3 packets.

CLI References

See "snmp-server engine-id" on page 22-10 for CLI reference information.

Command Usage

- A local engine ID is automatically generated that is unique to the switch. This is referred to as the default engine ID. If the local engine ID is deleted or changed, all SNMP users will be cleared. You will need to reconfigure all existing users.

Parameters

These parameters are displayed in the web interface:

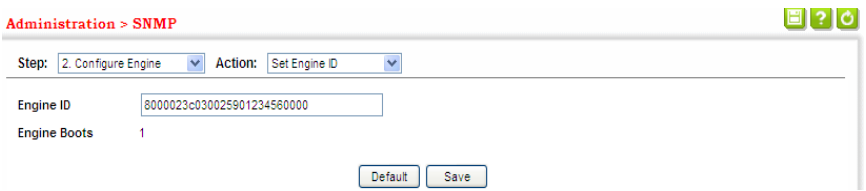
- **Engine ID** – A new engine ID can be specified by entering 9 to 64 hexadecimal characters (5 to 32 octets in hexadecimal format). If an odd number of characters are specified, a trailing zero is added to the value to fill in the last octet. For example, the value “123456789” is equivalent to “1234567890”.
- **Engine Boots** – The number of times that the engine has (re-)initialized since the Engine ID was last configured.

Web Interface

To configure the local SNMP engine ID:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE ENGINE from the STEP list.
3. Select SET ENGINE ID from the ACTION list.
4. Enter an ID of a least 9 hexadecimal characters.
5. Click APPLY

Figure 15-20. Configuring the Local Engine ID for SNMP



Specifying a Remote Engine ID

Use the ADMINISTRATION > SNMP (CONFIGURE ENGINE - ADD REMOTE ENGINE) page to configure a engine ID for a remote management station. To allow management access from an SNMPv3 user on a remote device, you must first specify the engine identifier for the SNMP agent on the remote device where the user resides. The remote engine ID is used to compute the security digest for authentication and encryption of packets passed between the switch and a user on the remote host.

CLI References

See "snmp-server engine-id" on page 22-10 for CLI reference information.

Command Usage

- SNMP passwords are localized using the engine ID of the authoritative agent. For informs, the authoritative SNMP agent is the remote agent. You therefore need to configure the remote agent's SNMP engine ID before you can send proxy requests or informs to it (see "Configuring Remote SNMPv3 Users" on page 15-46).

Parameters

These parameters are displayed in the web interface:

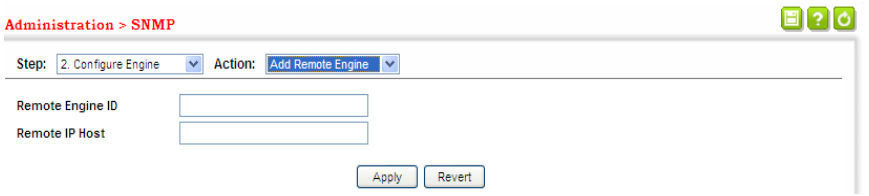
- **Remote Engine ID** – The engine ID can be specified by entering 9 to 64 hexadecimal characters (5 to 32 octets in hexadecimal format). If an odd number of characters are specified, a trailing zero is added to the value to fill in the last octet. For example, the value "123456789" is equivalent to "1234567890".
- **Remote IP Host** – The IP address of a remote management station which is using the specified engine ID.

Web Interface

To configure a remote SNMP engine ID:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE ENGINE from the STEP list.
3. Select ADD REMOTE ENGINE from the ACTION list.
4. Enter an ID of a least 9 hexadecimal characters, and the IP address of the remote host.
5. Click APPLY

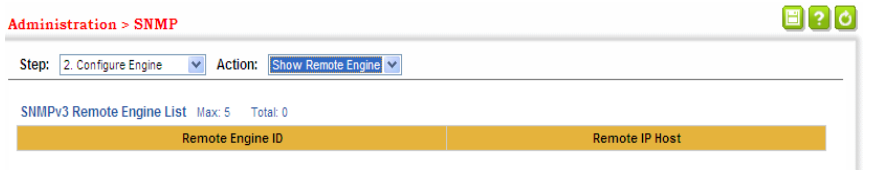
Figure 15-21. Configuring a Remote Engine ID for SNMP



To show the remote SNMP engine IDs:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE ENGINE from the STEP list.
3. Select SHOW REMOTE ENGINE from the ACTION list.

Figure 15-22. Showing Remote Engine IDs for SNMP


Administration > SNMP
Step: 2. Configure Engine
Action: Show Remote Engine
SNMPv3 Remote Engine List Max: 5 Total: 0
Remote Engine ID
Remote IP Host

Setting SNMPv3 Views

Use the ADMINISTRATION > SNMP (CONFIGURE VIEW) page to configure SNMPv3 views which are used to restrict user access to specified portions of the MIB tree. The predefined view “defaultview” includes access to the entire MIB tree.

CLI References

See "snmp-server view" on page 22-15 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Add View

- **View Name** – The name of the SNMP view. (Range: 1-64 characters)
- **OID Subtree** – Specifies the initial object identifier of a branch within the MIB tree. Wild cards can be used to mask a specific portion of the OID string. Use the Add OID Subtree page to configure additional object identifiers.
- **Type** – Indicates if the object identifier of a branch within the MIB tree is included or excluded from the SNMP view.

Add OID Subtree

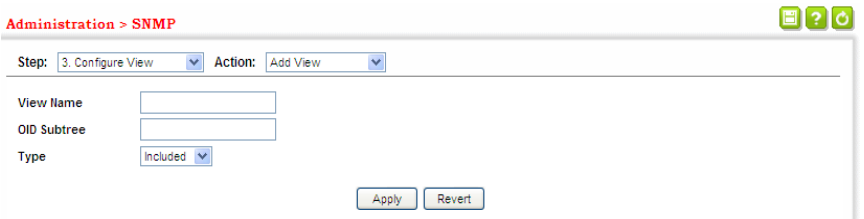
- **View Name** – Lists the SNMP views configured in the Add View page.
- **OID Subtree** – Adds an additional object identifier of a branch within the MIB tree to the selected View. Wild cards can be used to mask a specific portion of the OID string.
- **Type** – Indicates if the object identifier of a branch within the MIB tree is included or excluded from the SNMP view.

Web Interface

To configure an SNMP view of the switch's MIB database:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE VIEW from the STEP list.
3. Select ADD VIEW from the ACTION list.
4. Enter a view name and specify the initial OID subtree in the switch's MIB database to be included or excluded in the view. Use the ADD OID SUBTREE page to add additional object identifier branches to the view.
5. Click APPLY.

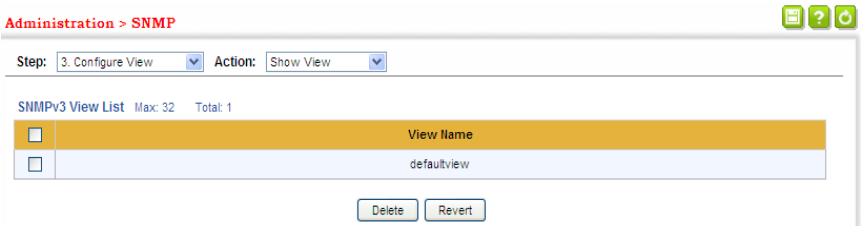
Figure 15-23. Creating an SNMP View



To show the SNMP views of the switch's MIB database:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE VIEW from the STEP list.
3. Select SHOW VIEW from the ACTION list.

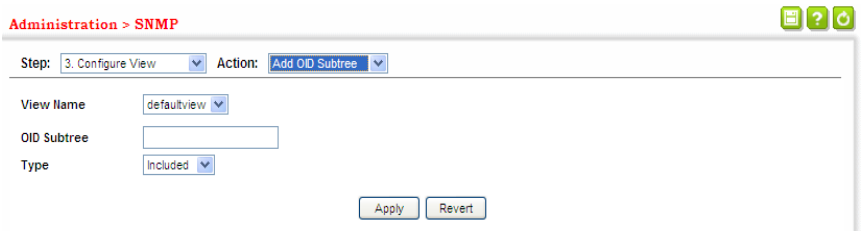
Figure 15-24. Showing SNMP Views



To add an object identifier to an existing SNMP view of the switch's MIB database:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE VIEW from the STEP list.
3. Select ADD OID SUBTREE from the ACTION list.
4. Select a view name from the list of existing views, and specify an additional OID subtree in the switch's MIB database to be included or excluded in the view.
5. Click APPLY

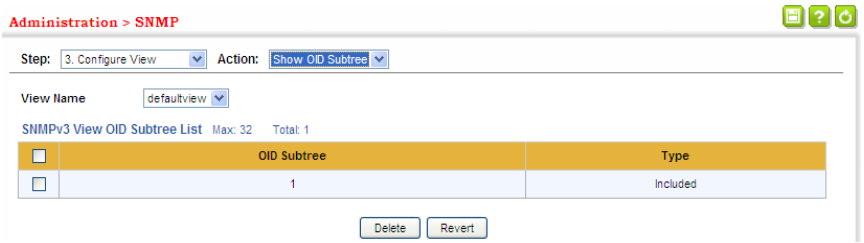
Figure 15-25. Adding an OID Subtree to an SNMP View



To show the OID branches configured for the SNMP views of the switch's MIB database:

1. Click ADMINISTRATION, SNMP.
2. Select CONFIGURE VIEW from the STEP list.
3. Select SHOW OID SUBTREE from the ACTION list.
4. Select a view name from the list of existing views.

Figure 15-26. Showing the OID Subtree Configured for SNMP Views



Configuring SNMPv3 Groups

Use the ADMINISTRATION > SNMP (CONFIGURE GROUP) page to add an SNMPv3 group which can be used to set the access policy for its assigned users, restricting them to specific read, write, and notify views. You can use the pre-defined default groups or create new groups to map a set of SNMP users to SNMP views.

CLI References

See "show snmp group" on page 22-16 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Group Name** – The name of the SNMP group to which the user is assigned. (Range: 1-32 characters)
- **Security Model** – The user security model; SNMP v1, v2c or v3.
- **Security Level** – The following security levels are only used for the groups assigned to the SNMP security model:
  - **noAuthNoPriv** – There is no authentication or encryption used in SNMP communications. (This is the default security level.)
  - **AuthNoPriv** – SNMP communications use authentication, but the data is not encrypted.
  - **AuthPriv** – SNMP communications use both authentication and encryption.
- **Read View** – The configured view for read access. (Range: 1-64 characters)
- **Write View** – The configured view for write access. (Range: 1-64 characters)
- **Notify View** – The configured view for notifications. (Range: 1-64 characters)

Table 15-8. Supported Notification Messages

Model	Level	Group
RFC 1493 Traps		
newRoot	1.3.6.1.2.1.17.0.1	The newRoot trap indicates that the sending agent has become the new root of the Spanning Tree; the trap is sent by a bridge soon after its election as the new root, e.g., upon expiration of the Topology Change Timer immediately subsequent to its election.
topologyChange	1.3.6.1.2.1.17.0.2	A topologyChange trap is sent by a bridge when any of its configured ports transitions from the Learning state to the Forwarding state, or from the Forwarding state to the Discarding state. The trap is not sent if a newRoot trap is sent for the same transition.
SNMPv2 Traps		
coldStart	1.3.6.1.6.3.1.1.5.1	A coldStart trap signifies that the SNMPv2 entity, acting in an agent role, is reinitializing itself and that its configuration may have been altered.
warmStart	1.3.6.1.6.3.1.1.5.2	A warmStart trap signifies that the SNMPv2 entity, acting in an agent role, is reinitializing itself such that its configuration is unaltered.
linkDown[a]	1.3.6.1.6.3.1.1.5.3	A linkDown trap signifies that the SNMP entity, acting in an agent role, has detected that the ifOperStatus object for one of its communication links is about to enter the down state from some other state (but not from the notPresent state). This other state is indicated by the included value of ifOperStatus.
linkUp*	1.3.6.1.6.3.1.1.5.4	A linkUp trap signifies that the SNMP entity, acting in an agent role, has detected that the ifOperStatus object for one of its communication links left the down state and transitioned into some other state (but not into the notPresent state). This other state is indicated by the included value of ifOperStatus.
authenticationFailure*	1.3.6.1.6.3.1.1.5.5	An authenticationFailure trap signifies that the SNMPv2 entity, acting in an agent role, has received a protocol message that is not properly authenticated. While all implementations of the SNMPv2 must be capable of generating this trap, the snmpEnableAuthenTraps object indicates whether this trap will be generated.
RMON Events (V2)		
risingAlarm	1.3.6.1.2.1.16.0.1	The SNMP trap that is generated when an alarm entry crosses its rising threshold and generates an event that is configured for sending SNMP traps.
fallingAlarm	1.3.6.1.2.1.16.0.2	The SNMP trap that is generated when an alarm entry crosses its falling threshold and generates an event that is configured for sending SNMP traps.

Table 15-8. Supported Notification Messages (Continued)

Model	Level	Group
Private Traps		
swPowerStatusChangeTrap	1.3.6.1.4.1.10876.101.202.2.1.0.1	This trap is sent when the power state changes.
swFanFailureTrap	1.3.6.1.4.1.10876.101.202..2.1.0.17	This trap is sent when the fan fails.
swFanRecoverTrap	1.3.6.1.4.1.10876.101.202..2.1.0.18	This trap is sent when fan failure has recovered.
swPortSecurityTrap	1.3.6.1.4.1.10876.101.202.2.1.0.36	This trap is sent when the port is being intruded. This trap will only be sent when the portSecActionTrap is enabled.
swAuthenticationFailure	1.3.6.1.4.1.10876.101.202.2.1.0.66	This trap will be triggered if authentication fails.
swAuthenticationSuccess	1.3.6.1.4.1.10876.101.202.2.1.0.67	This trap will be triggered if authentication is successful.
swAtcBcastStormAlarmFireTrap	1.3.6.1.4.1.10876.101.202.2.1.0.70	When broadcast traffic is detected as a storm, this trap is fired.
swAtcBcastStormAlarmClearTrap	1.3.6.1.4.1.10876.101.202.2.1.0.71	When a broadcast storm is detected as normal traffic, this trap is fired.
swAtcBcastStormTcApplyTrap	1.3.6.1.4.1.10876.101.202.2.1.0.72	When ATC is activated, this trap is fired.
swAtcBcastStormTcReleaseTrap	1.3.6.1.4.1.10876.101.202.2.1.0.73	When ATC is released, this trap is fired.
swAtcMcastStormAlarmFireTrap	1.3.6.1.4.1.10876.101.202.2.1.0.74	When multicast traffic is detected as the storm, this trap is fired.
swAtcMcastStormAlarmClearTrap	1.3.6.1.4.1.10876.101.202.2.1.0.75	When multicast storm is detected as normal traffic, this trap is fired.
swAtcMcastStormTcApplyTrap	1.3.6.1.4.1.10876.101.202.2.1.0.76	When ATC is activated, this trap is fired.
swAtcMcastStormTcReleaseTrap	1.3.6.1.4.1.10876.101.202.2.1.0.77	When ATC is released, this trap is fired.
stpBecomeRootBridgeTrap	1.3.6.1.4.1.10876.101.202.2.1.0.86	The stpBecomeRootBridge trap indicates that the sending agent has become the new root of the Spanning Tree; the trap is sent by a bridge soon after it has been elected as the new root.
stpPortEnterForwardingTrap	1.3.6.1.4.1.10876.101.202.2.1.0.87	The trap is sent by a bridge when any of its configured ports transit from Learning state to Forwarding state.
stpRootPortChangedTrap	1.3.6.1.4.1.10876.101.202.2.1.0.88	The trap is sent when the root port of a bridge has changed.
stpRootBridgeChangedTrap	1.3.6.1.4.1.10876.101.202.2.1.0.89	The trap will be sent when the root bridge of bridges has changed and the bridge sending off the trap is not the root in STP topology.
swLoopbackDetectionTrap	1.3.6.1.4.1.10876.101.202.2.1.0.95	This trap is sent when loopback BPDUs have been detected.

Table 15-8. Supported Notification Messages (Continued)

Model	Level	Group
autoUpgradeTrap	1.3.6.1.4.1.10876.101 .202.2.1.0.104	This trap is sent when auto upgrade is executed.
swCpuUtiRisingNotification	1.3.6.1.4.1.10876.101 .202.2.1.0.107	This notification indicates that the CPU utilization has risen from cpuUtiFallingThreshold to cpuUtiRisingThreshold.
swCpuUtiFallingNotification	1.3.6.1.4.1.10876.101 .202.2.1.0.108	This notification indicates that the CPU utilization has fallen from cpuUtiRisingThreshold to cpuUtiFallingThreshold.
swMemoryUtiRisingThresholdNotification	1.3.6.1.4.1.10876.101 .202.2.1.0.109	This notification indicates that the memory utilization has risen from memoryUtiFallingThreshold to memoryUtiRisingThreshold.
swMemoryUtiFallingThresholdNotification	1.3.6.1.4.1.10876.101 .202.2.1.0.110	This notification indicates that the memory utilization has fallen from memoryUtiRisingThreshold to memoryUtiFallingThreshold.
swIpFilterInetRejectTrap	1.3.6.1.4.1.10876.101 .202..2.1.0.111	This trap is sent when an incorrect IP address is rejected by the IP filter.

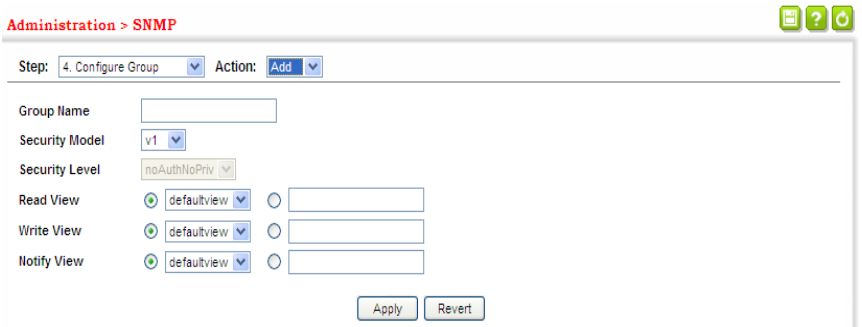
a. These are legacy notifications and therefore must be enabled in conjunction with the corresponding traps on the SNMP CONFIGURATION menu.

Web Interface

To configure an SNMP group:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE GROUP from the STEP list.
3. Select ADD from the ACTION list.
4. Enter a group name, assign a security model and level, and then select read, write, and notify views.
5. Click APPLY

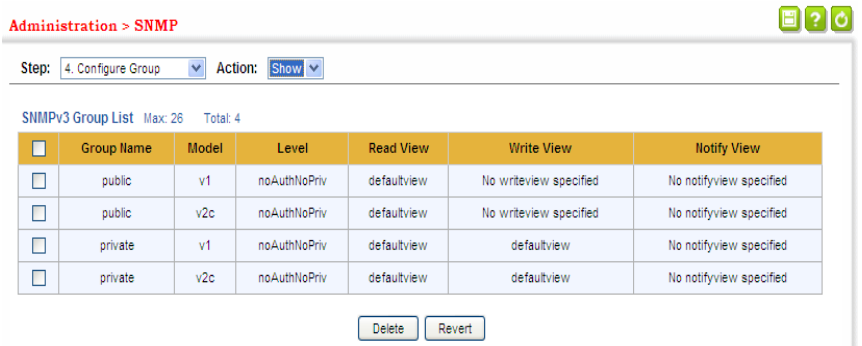
Figure 15-27. Creating an SNMP Group



To show SNMP groups:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE GROUP from the STEP list.
3. Select SHOW from the ACTION list.

Figure 15-28. Showing SNMP Groups


Administration > SNMP
Step: 4. Configure Group
Action: Show
SNMPv3 Group List Max: 26 Total: 4
Group Name
Model
Level
Read View
Write View
Notify View
public v1 noAuthNoPriv defaultview No writeview specified No notifyview specified
public v2c noAuthNoPriv defaultview No writeview specified No notifyview specified
private v1 noAuthNoPriv defaultview defaultview No notifyview specified
private v2c noAuthNoPriv defaultview defaultview No notifyview specified
Delete
Revert

Setting Community Access Strings

Use the Administration, SNMP (CONFIGURE USER - ADD COMMUNITY) page to configure up to five community strings authorized for management access by clients using SNMP v1 and v2c. For security reasons, you should consider removing the default strings.

CLI References

See "snmp-server community" on page 22-3 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Community String** – A community string that acts like a password and permits access to the SNMP protocol.

  Range: 1-32 characters, case sensitive
  Default strings: “public” (Read-Only), “private” (Read/Write)

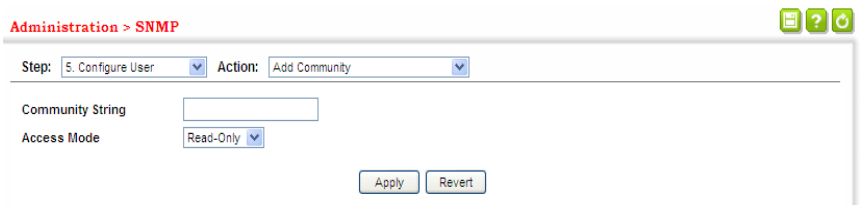
- **Access Mode** – Specifies the access rights for the community string:
  - **Read-Only** – Authorized management stations are only able to retrieve MIB objects.
  - **Read/Write** – Authorized management stations are able to both retrieve and modify MIB objects.

Web Interface

To set a community access string:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE USER from the STEP list.
3. Select ADD COMMUNITY from the ACTION list.
4. Add new community strings as required, and select the corresponding access rights from the ACCESS MODE list.
5. Click APPLY.

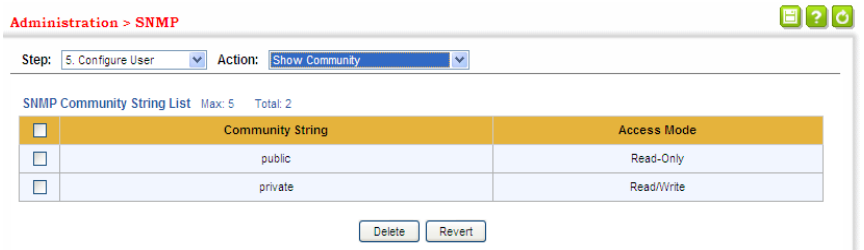
Figure 15-29. Setting Community Access Strings



To show the community access strings:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE USER from the STEP list.
3. Select SHOW COMMUNITY from the ACTION list.

Figure 15-30. Showing Community Access Strings



Configuring Local SNMPv3 Users

Use the ADMINISTRATION > SNMP (CONFIGURE USER - ADD SNMPV3 LOCAL USER) page to authorize management access for SNMPv3 clients, or to identify the source of SNMPv3 trap messages sent from the local switch. Each SNMPv3 user is defined by a unique name. Users must be configured with a specific security level and assigned to a group. The SNMPv3 group restricts users to a specific read, write, and notify view.

CLI References

See "snmp-server user" on page 22-13 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **User Name** – The name of user connecting to the SNMP agent. (Range: 1-32 characters)
- **Group Name** – The name of the SNMP group to which the user is assigned. (Range: 1-32 characters)
- **Security Model** – The user security model; SNMP v1, v2c or v3.
- **Security Level** – The following security levels are only used for the groups assigned to the SNMP security model:
  - **noAuthNoPriv** – There is no authentication or encryption used in SNMP communications. (This is the default security level.)
  - **AuthNoPriv** – SNMP communications use authentication, but the data is not encrypted.

- **AuthPriv** – SNMP communications use both authentication and encryption.

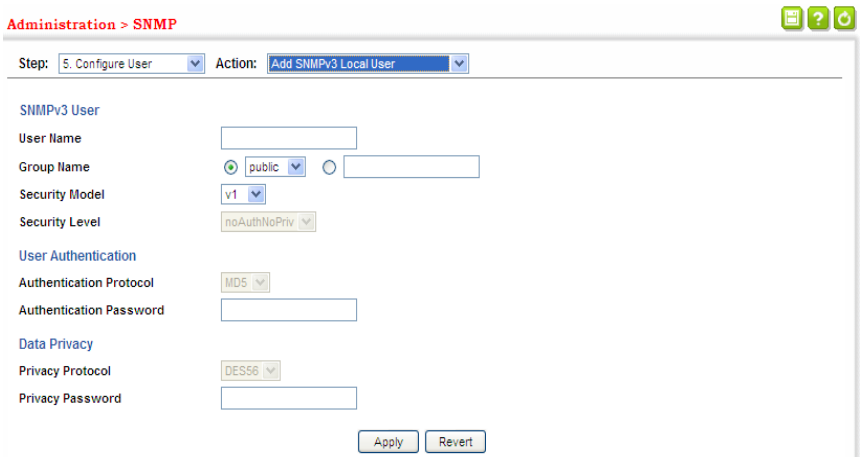
- **Authentication Protocol** – The method used for user authentication. (Options: MD5, SHA; Default: MD5)
- **Authentication Password** – A minimum of eight plain text characters is required.
- **Privacy Protocol** – The encryption algorithm use for data privacy; only 56-bit DES is currently available.
- **Privacy Password** – A minimum of eight plain text characters is required.

Web Interface

To configure a local SNMPv3 user:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE USER from the STEP list.
3. Select ADD SNMPV3 LOCAL USER from the ACTION list.
4. Enter a name and assign it to a group. If the security model is set to SNMPv3 and the security level is authNoPriv or authPriv, then an authentication protocol and password must be specified. If the security level is authPriv, a privacy password must also be specified.
5. Click APPLY.

Figure 15-31. Configuring Local SNMPv3 Users

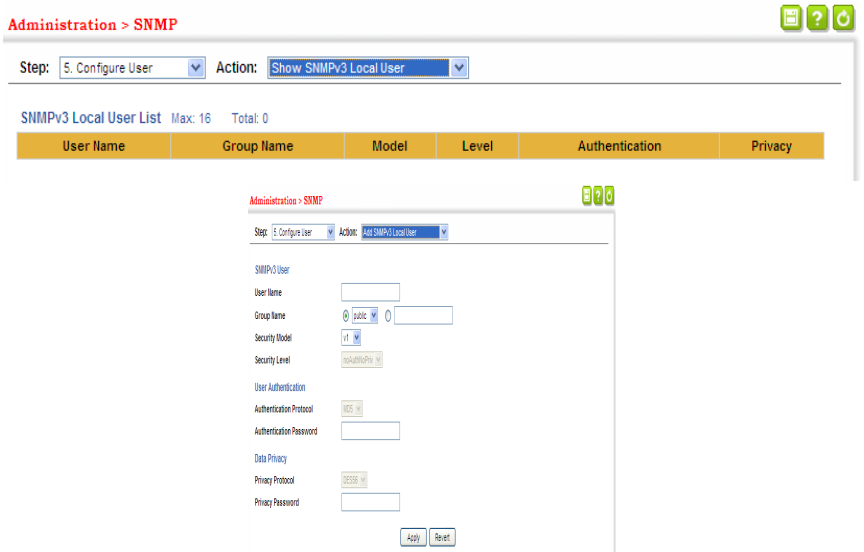


To show local SNMPv3 users:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE USER from the STEP list.

3. Select SHOW SNMPV3 LOCAL USER from the ACTION list.

Figure 15-32. Showing Local SNMPv3 Users



Configuring Remote SNMPv3 Users

Use the ADMINISTRATION > SNMP (CONFIGURE USER - ADD SNMPV3 REMOTE USER) page to identify the source of SNMPv3 inform messages sent from the local switch. Each SNMPv3 user is defined by a unique name. Users must be configured with a specific security level and assigned to a group. The SNMPv3 group restricts users to a specific read, write, and notify view.

CLI References

See "snmp-server user" on page 22-13 for CLI reference information.

Command Usage

- To grant management access to an SNMPv3 user on a remote device, you must first specify the engine identifier for the SNMP agent on the remote device where the user resides. The remote engine ID is used to compute the security digest for authentication and encryption of packets passed between the switch and the remote user (see "Specifying Notification Managers" on page 15-49 and "Specifying a Remote Engine ID" on page 15-34).

Parameters

These parameters are displayed in the web interface:

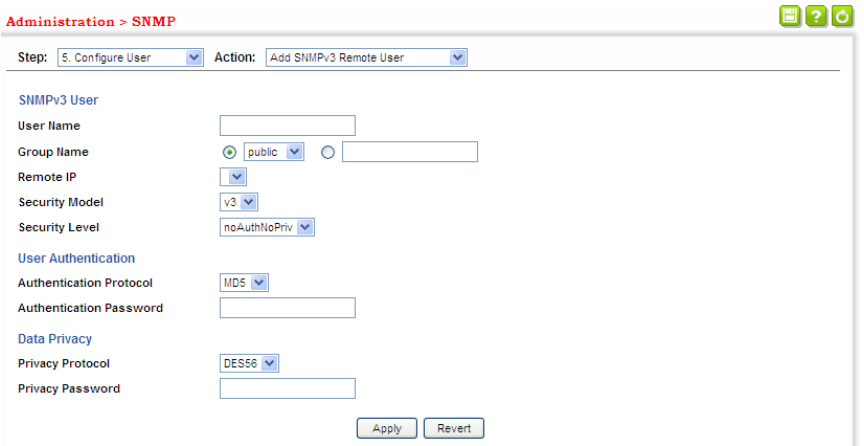
- **User Name** – The name of user connecting to the SNMP agent. (Range: 1-32 characters)
- **Group Name** – The name of the SNMP group to which the user is assigned. (Range: 1-32 characters)
- **Remote IP** – The Internet address of the remote device where the user resides.
- **Security Model** – The user security model; SNMP v1, v2c or v3. (Default: v3)
- **Security Level** – The following security levels are only used for the groups assigned to the SNMP security model:
  - **noAuthNoPriv** – There is no authentication or encryption used in SNMP communications. (This is the default security level.)
  - **AuthNoPriv** – SNMP communications use authentication, but the data is not encrypted.
  - **AuthPriv** – SNMP communications use both authentication and encryption.
- **Authentication Protocol** – The method used for user authentication. (Options: MD5, SHA; Default: MD5)
- **Authentication Password** – A minimum of eight plain text characters is required.
- **Privacy Protocol** – The encryption algorithm use for data privacy; only 56-bit DES is currently available.
- **Privacy Password** – A minimum of eight plain text characters is required.

Web Interface

To configure a remote SNMPv3 user:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE USER from the STEP list.
3. Select ADD SNMPV3 REMOTE USER from the ACTION list.
4. Enter a name and assign it to a group. Enter the IP address to identify the source of SNMPv3 inform messages sent from the local switch. If the security model is set to SNMPV3 and the security level is AUTHNOPRIV or AUTHPRIV, then an authentication protocol and password must be specified. If the security level is AUTHPRIV, a privacy password must also be specified.
5. Click APPLY.

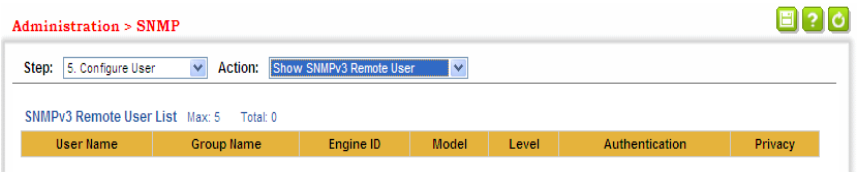
Figure 15-33. Configuring Remote SNMPv3 Users



To show remote SNMPv3 users:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE USER from the STEP list.
3. Select SHOW SNMPV3 REMOTE USER from the ACTION list.

Figure 15-34. Showing Remote SNMPv3 Users



Specifying Notification Managers

Use the ADMINISTRATION > SNMP (CONFIGURE NOTIFICATION) page to specify the host devices to be sent notifications and the types of notifications to send. Notifications indicating status changes are issued by the switch to the specified notification managers. You must specify notification managers so that key events are reported by this switch to your management station (using network management software). You can specify up to five management stations that will receive authentication failure messages and other notification messages from the switch.

CLI References

See "snmp-server host" on page 22-8 and "snmp-server enable traps" on page 22-7 for CLI reference information.

Command Usage

Notifications are issued by the switch as trap messages by default. The recipient of a trap message does not send a response to the switch. Traps are therefore not as reliable as inform messages, which include a request for acknowledgement of receipt. Informs can be used to ensure that critical information is received by the host. However, note that informs consume more system resources because they must be kept in memory until a response is received. Informs also add to network traffic. You should consider these effects when deciding whether to issue notifications as traps or informs.

To send an inform to a SNMPv2c host, complete these steps:

1. Enable the SNMP agent (see "Configuring Global Settings for SNMP" on page 15-32).
2. Create a view with the required notification messages (see "Setting SNMPv3 Views" on page 15-35).
3. Configure the group (matching the community string specified on the CONFIGURE NOTIFICATION - ADD page) to include the required notify view (see "Configuring SNMPv3 Groups" on page 15-38).
4. Enable informs as described in the following pages.

To send an inform to a SNMPv3 host, complete these steps:

1. Enable the SNMP agent (see "Configuring Global Settings for SNMP" on page 15-32).
2. Create a local SNMPv3 user to use in the message exchange process (see "Configuring Local SNMPv3 Users" on page 15-44). If the user specified in the notification configuration page does not exist, an SNMPv3 group will be automatically created using the name of the specified local user, and default settings for the read, write, and notify view.
3. Create a view with the required notification messages (see "Setting SNMPv3 Views" on page 15-35).

4. Create a group that includes the required notify view (see "Configuring SNMPv3 Groups" on page 15-38).
5. Enable informs as described in the following pages.

Parameters

These parameters are displayed in the web interface:

SNMP Version 1

- **IP Address** – IP address of a new management station to receive notification message (i.e., the targeted recipient).
- **Version** – Specifies whether to send notifications using SNMP v1, v2c, or v3. (Default: v1)
- **Community String** – Specifies a valid community string for the new notification manager entry. (Range: 1-32 characters, case sensitive)

  Although you can set this string in the CONFIGURE NOTIFICATION – ADD page, we recommend defining it in the CONFIGURE USER – ADD COMMUNITY page.
- **UDP Port** – Specifies the UDP port number used by the notification manager. (Default: 162)

SNMP Version 2c

- **IP Address** – IP address of a new management station to receive notification message (i.e., the targeted recipient).
- **Version** – Specifies whether to send notifications using SNMP v1, v2c, or v3.
- **Notification Type**
  - **Traps** – Notifications are sent as trap messages.
  - **Inform** – Notifications are sent as inform messages. Note that this option is only available for version 2c and 3 hosts. (Default: traps are used)
  - **Timeout** – The number of seconds to wait for an acknowledgment before resending an inform message. (Range: 0-2147483647 centiseconds; Default: 1500 centiseconds)
  - **Retry Times** – The maximum number of times to resend an inform message if the recipient does not acknowledge receipt. (Range: 0-255; Default: 3)
- **Community String** – Specifies a valid community string for the new notification manager entry. (Range: 1-32 characters, case sensitive)

  Although you can set this string in the CONFIGURE NOTIFICATION – ADD page, we recommend defining it in the CONFIGURE USER – ADD COMMUNITY page.
- **UDP Port** – Specifies the UDP port number used by the notification manager. (Default: 162)

SNMP Version 3

- **IP Address** – IP address of a new management station to receive notification message (i.e., the targeted recipient).
- **Version** – Specifies whether to send notifications using SNMP v1, v2c, or v3.
- **Notification Type**
  - **Traps** – Notifications are sent as trap messages.
  - **Inform** – Notifications are sent as inform messages. Note that this option is only available for version 2c and 3 hosts. (Default: traps are used)
  - **Timeout** – The number of seconds to wait for an acknowledgment before resending an inform message. (Range: 0-2147483647 centiseconds; Default: 1500 centiseconds)
  - **Retry Times** – The maximum number of times to resend an inform message if the recipient does not acknowledge receipt. (Range: 0-255; Default: 3)
- **Local User Name** – The name of a local user which is used to identify the source of SNMPv3 notification messages sent from the local switch. (Range: 1-32 characters)

  If an account for the specified user has not been created ("Configuring Local SNMPv3 Users" on page 15-44), one will be automatically generated.
- **Remote User Name** – The name of a remote user which is used to identify the source of SNMPv3 inform messages sent from the local switch. (Range: 1-32 characters)

  If an account for the specified user has not been created ("Configuring Remote SNMPv3 Users" on page 15-46), one will be automatically generated.
- **UDP Port** – Specifies the UDP port number used by the notification manager. (Default: 162)
- **Security Level** – When notification version 3 is selected, you must specify one of the following security levels. (Default: noAuthNoPriv)
  - **noAuthNoPriv** – There is no authentication or encryption used in SNMP communications.
  - **AuthNoPriv** – SNMP communications use authentication, but the data is not encrypted.
  - **AuthPriv** – SNMP communications use both authentication and encryption.

Web Interface

To configure notification managers:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE NOTIFICATION from the STEP list.
3. Select ADD from the ACTION list.

4. Fill in the required parameters based on the selected SNMP version.
5. Click APPLY.

Figure 15-35. Configuring Notification Managers (SNMPv1)

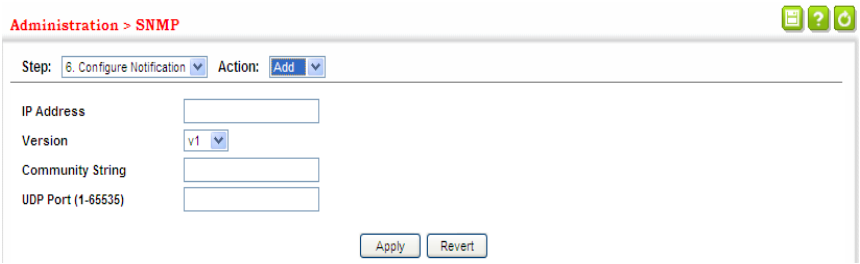


Figure 15-36. Configuring Notification Managers (SNMPv2c)

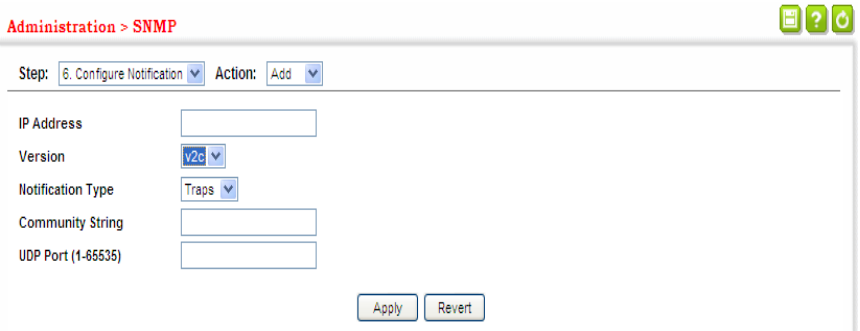
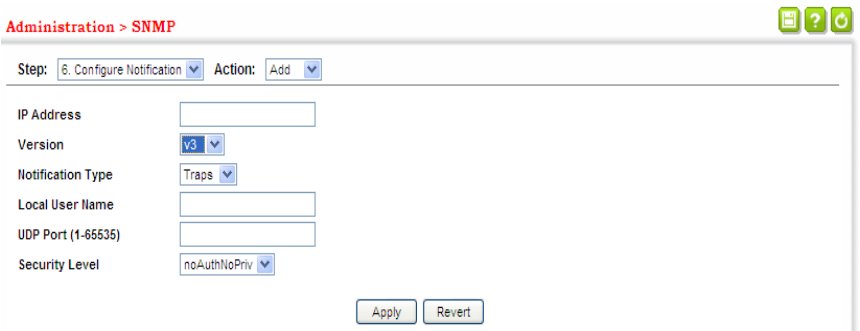


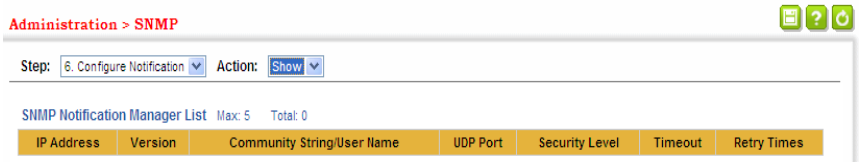
Figure 15-37. Configuring Notification Managers (SNMPv3)



To show configured notification managers:

1. Click ADMINISTRATION > SNMP.
2. Select CONFIGURE NOTIFICATION from the STEP list.
3. Select SHOW from the ACTION list.

Figure 15-38. Showing Notification Managers



15-5 Remote Monitoring

Remote Monitoring allows a remote device to collect information or respond to specified events on an independent basis. This switch is an RMON-capable device which can independently perform a wide range of tasks, significantly reducing network management traffic. It can continuously run diagnostics and log information on network performance. If an event is triggered, it can automatically notify the network administrator of a failure and provide historical information about the event. If it cannot connect to the management agent, it will continue to perform any specified tasks and pass data back to the management station the next time it is contacted.

The switch supports mini-RMON, which consists of the Statistics, History, Event and Alarm groups. When RMON is enabled, the system gradually builds up information about its physical interfaces, storing this information in the relevant RMON database group. A management agent then periodically communicates with the switch using the SNMP protocol. However, if the switch encounters a critical event, it can automatically send a trap message to the management agent which can then respond to the event if so configured.

Configuring RMON Alarms

Use the ADMINISTRATION > RMON (CONFIGURE GLOBAL - ADD - ALARM) page to define specific criteria that will generate response events. Alarms can be set to test data over any specified time interval, and can monitor absolute or changing values (such as a statistical counter reaching a specific value, or a statistic changing by a certain amount over the set interval). Alarms can be set to respond to rising or falling thresholds. (However, note that after an alarm is triggered it will not be triggered again until the statistical value crosses the opposite bounding threshold and then back across the trigger threshold.

CLI References

See Chapter 23: "Remote Monitoring Commands" on page 23-1 for CLI reference information.

Command Usage

- If an alarm is already defined for an index, the entry must be deleted before any changes can be made.

Parameters

These parameters are displayed in the web interface:

- **Index** – Index to this entry. (Range: 1-65535)
- **Variable** – The object identifier of the MIB variable to be sampled. Only variables of the type *etherStatsEntry.n.n* may be sampled.

  Note that *etherStatsEntry.n* uniquely defines the MIB variable, and *etherStatsEntry.n.n* defines the MIB variable, plus the *etherStatsIndex*. For example, 1.3.6.1.2.1.16.1.1.1.6.1 denotes *etherStatsBroadcastPkt*s, plus the *etherStatsIndex* of 1.
- **Interval** – The polling interval. (Range: 1-31622400 seconds)
- **Sample Type** – Tests for absolute or relative changes in the specified variable.
  - **Absolute** – The variable is compared directly to the thresholds at the end of the sampling period.
  - **Delta** – The last sample is subtracted from the current value and the difference is then compared to the thresholds.
- **Rising Threshold** – If the current value is greater than or equal to the rising threshold, and the last sample value was less than this threshold, then an alarm will be generated. After a rising event has been generated, another such event will not be generated until the sampled value has fallen below the rising threshold, reaches the falling threshold, and again moves back up to the rising threshold. (Range: 0-2147483647)
- **Rising Event Index** – The index of the event to use if an alarm is triggered by monitored variables reaching or crossing above the rising threshold. If there is no corresponding entry in the event control table, then no event will be generated. (Range: 0-65535)
- **Falling Threshold** – If the current value is less than or equal to the falling threshold, and the last sample value was greater than this threshold, then an alarm will be generated. After a falling event has been generated, another such event will not be generated until the sampled value has risen above the falling threshold, reaches the rising threshold, and again moves back down to the failing threshold. (Range: 0-2147483647)

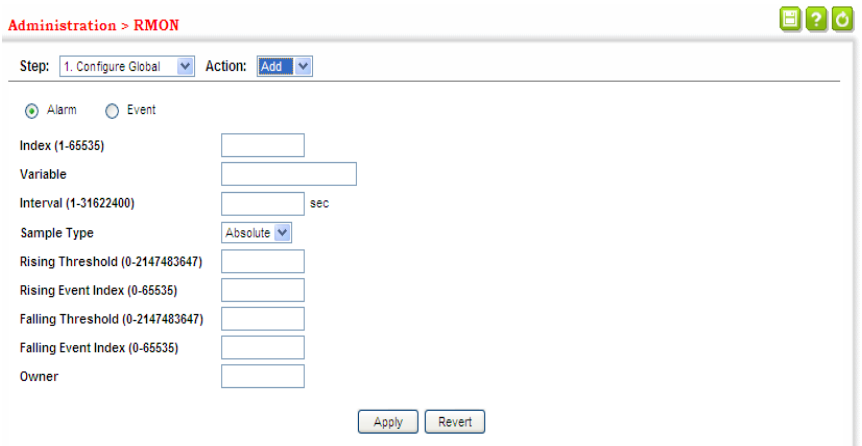
- **Falling Event Index** – The index of the event to use if an alarm is triggered by monitored variables reaching or crossing below the falling threshold. If there is no corresponding entry in the event control table, then no event will be generated. (Range: 0-65535)
- **Owner** – Name of the person who created this entry. (Range: 1-127 characters)

Web Interface

To configure an RMON alarm:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE GLOBAL from the STEP list.
3. Select ADD from the ACTION list.
4. Click ALARM.
5. Enter an index number, the MIB object to be polled (*etherStatsEntry.n.n*), the polling interval, the sample type, the thresholds, and the event to trigger.
6. Click APPLY

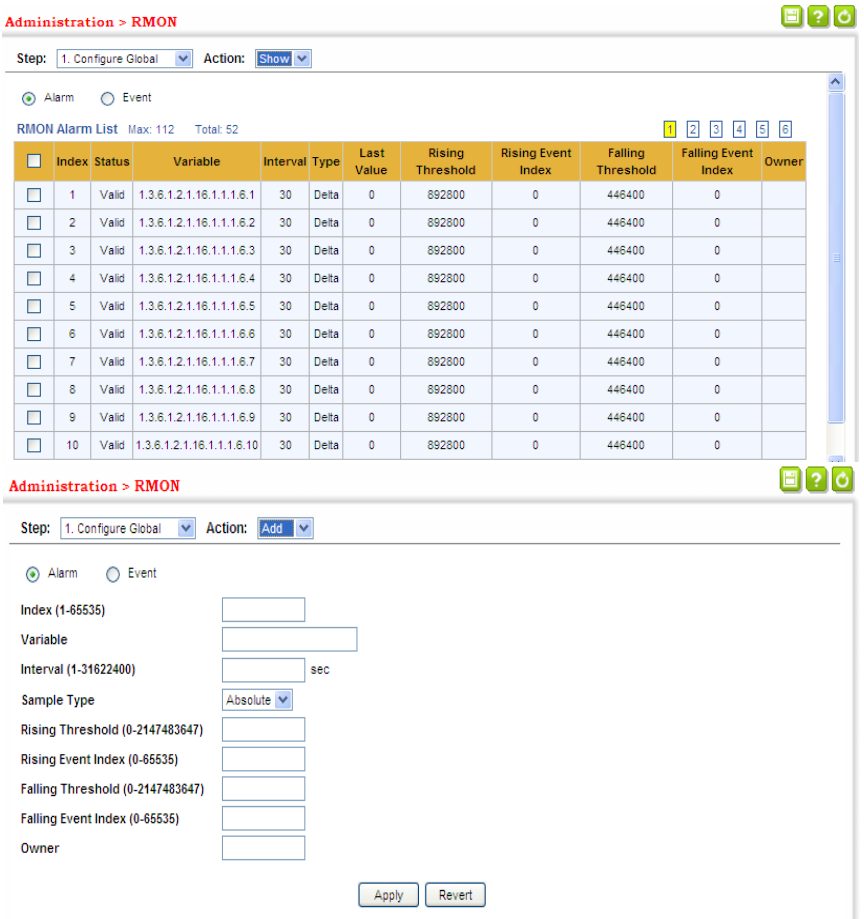
Figure 15-39. Configuring an RMON Alarm



To show configured RMON alarms:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE GLOBAL from the STEP list.
3. Select SHOW from the ACTION list.
4. Click ALARM.

Figure 15-40. Showing Configured RMON Alarms


Administration > RMON
Step: 1. Configure Global Action: Show
Alarm Event
RMON Alarm List Max: 112 Total: 52
1 2 3 4 5 6
Index Status Variable Interval Type Last Value Rising Threshold Rising Event Index Falling Threshold Falling Event Index Owner
1 Valid 1.3.6.1.2.1.16.1.1.1.6.1 30 Delta 0 892800 0 446400 0
2 Valid 1.3.6.1.2.1.16.1.1.1.6.2 30 Delta 0 892800 0 446400 0
3 Valid 1.3.6.1.2.1.16.1.1.1.6.3 30 Delta 0 892800 0 446400 0
4 Valid 1.3.6.1.2.1.16.1.1.1.6.4 30 Delta 0 892800 0 446400 0
5 Valid 1.3.6.1.2.1.16.1.1.1.6.5 30 Delta 0 892800 0 446400 0
6 Valid 1.3.6.1.2.1.16.1.1.1.6.6 30 Delta 0 892800 0 446400 0
7 Valid 1.3.6.1.2.1.16.1.1.1.6.7 30 Delta 0 892800 0 446400 0
8 Valid 1.3.6.1.2.1.16.1.1.1.6.8 30 Delta 0 892800 0 446400 0
9 Valid 1.3.6.1.2.1.16.1.1.1.6.9 30 Delta 0 892800 0 446400 0
10 Valid 1.3.6.1.2.1.16.1.1.1.6.10 30 Delta 0 892800 0 446400 0
Administration > RMON
Step: 1. Configure Global Action: Add
Alarm Event
Index (1-65535)
Variable
Interval (1-31622400) sec
Sample Type Absolute
Rising Threshold (0-2147483647)
Rising Event Index (0-65535)
Falling Threshold (0-2147483647)
Falling Event Index (0-65535)
Owner
Apply Revert

Configuring RMON Events

Use the ADMINISTRATION > RMON (CONFIGURE GLOBAL - ADD - EVENT) page to set the action to take when an alarm is triggered. The response can include logging the alarm or sending a message to a trap manager. Alarms and corresponding events provide a way of immediately responding to critical network problems.

CLI References

See Chapter 23: "Remote Monitoring Commands" on page 23-1 for CLI reference information.

Command Usage

- If an alarm is already defined for an index, the entry must be deleted before any changes can be made.
- One default event is configured as follows:

  event Index = 1

  Description: RMON_TRAP_LOG

  Event type: log & trap

  Event community name is public

  Owner is RMON_SNMP

Parameters

These parameters are displayed in the web interface:

- **Index** – Index to this entry. (Range: 1-65535)
- **Type** – Specifies the type of event to initiate:
  - **None** – No event is generated.
  - **Log** – Generates an RMON log entry when the event is triggered. Log messages are processed based on the current configuration settings for event logging (see "System Log Configuration" on page 15-1).
  - **Trap** – Sends a trap message to all configured trap managers (see "Specifying Notification Managers" on page 15-49).
  - **Log and Trap** – Logs the event and sends a trap message.
- **Community** – A password-like community string sent with the trap operation to SNMP v1 and v2c hosts.

  Although the community string can be set on this configuration page, it is recommended that it be defined on the SNMP trap configuration page (see "Setting Community Access Strings" on page 15-43) prior to configuring it here. (Range: 1-127 characters)
- **Description** – A comment that describes this event. (Range: 1-127 characters)

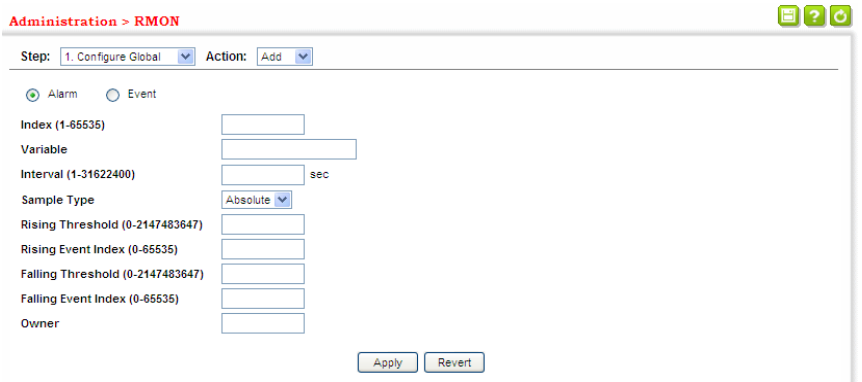
- **Owner** – Name of the person who created this entry. (Range: 1-127 characters)

Web Interface

To configure an RMON event:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE GLOBAL from the STEP list.
3. Select ADD from the ACTION list.
4. Click EVENT.
5. Enter an index number, the type of event to initiate, the community string to send with trap messages, the name of the person who created this event, and a brief description of the event.
6. Click APPLY.

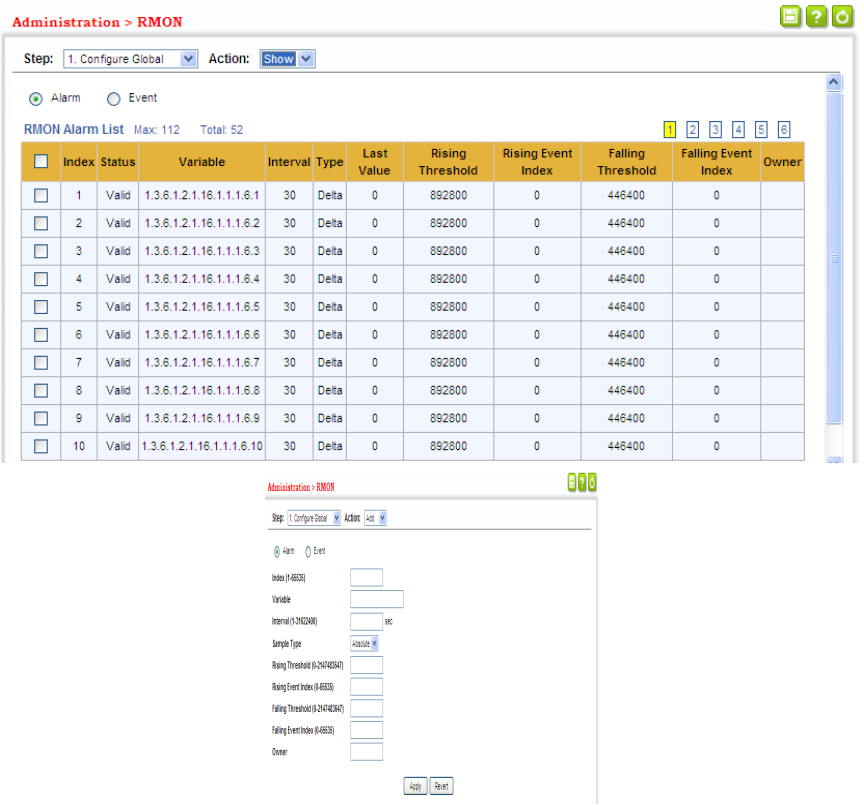
Figure 15-41. Configuring an RMON Event



To show configured RMON events:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE GLOBAL from the STEP list.
3. Select SHOW from the ACTION list.
4. Click EVENT.

Figure 15-42. Showing Configured RMON Events



Index	Status	Variable	Interval	Type	Last Value	Rising Threshold	Rising Event Index	Falling Threshold	Falling Event Index	Owner
1	Valid	1.3.6.1.2.1.16.1.1.1.6.1	30	Delta	0	892800	0	446400	0	
2	Valid	1.3.6.1.2.1.16.1.1.1.6.2	30	Delta	0	892800	0	446400	0	
3	Valid	1.3.6.1.2.1.16.1.1.1.6.3	30	Delta	0	892800	0	446400	0	
4	Valid	1.3.6.1.2.1.16.1.1.1.6.4	30	Delta	0	892800	0	446400	0	
5	Valid	1.3.6.1.2.1.16.1.1.1.6.5	30	Delta	0	892800	0	446400	0	
6	Valid	1.3.6.1.2.1.16.1.1.1.6.6	30	Delta	0	892800	0	446400	0	
7	Valid	1.3.6.1.2.1.16.1.1.1.6.7	30	Delta	0	892800	0	446400	0	
8	Valid	1.3.6.1.2.1.16.1.1.1.6.8	30	Delta	0	892800	0	446400	0	
9	Valid	1.3.6.1.2.1.16.1.1.1.6.9	30	Delta	0	892800	0	446400	0	
10	Valid	1.3.6.1.2.1.16.1.1.1.6.10	30	Delta	0	892800	0	446400	0	

Configuring RMON History Samples

Use the ADMINISTRATION > RMON (CONFIGURE INTERFACE - ADD - HISTORY) page to collect statistics on a physical interface to monitor network utilization, packet types, and errors. A historical record of activity can be used to track down intermittent problems. The record can be used to establish normal baseline activity, which may reveal problems associated with high traffic levels, broadcast storms, or other unusual events. It can also be used to predict network growth and plan for expansion before your network becomes too overloaded.

CLI References

See Chapter 23: "Remote Monitoring Commands" on page 23-1 for CLI reference information.

Command Usage

- Each index number equates to a port on the switch.
- If history collection is already enabled on an interface, the entry must be deleted before any changes can be made.
- The information collected for each sample includes:

  input octets, packets, broadcast packets, multicast packets, undersize packets, oversize packets, fragments, jabbers, CRC alignment errors, collisions, drop events, and network utilization.

  For a description of the statistics displayed on the SHOW DETAILS page, refer to "Showing Port or Trunk Statistics" on page 6-13.

Parameters

These parameters are displayed in the web interface:

- **Port** – The port number on the switch.
- **Index** - Index to this entry. (Range: 1-65535)
- **Interval** - The polling interval. (Range: 1-3600 seconds; Default: 1800 seconds)
- **Buckets** - The number of buckets requested for this entry. (Range: 1-65536; Default: 8)

  The number of buckets granted are displayed on the Show page.
- **Owner** - Name of the person who created this entry. (Range: 1-127 characters)

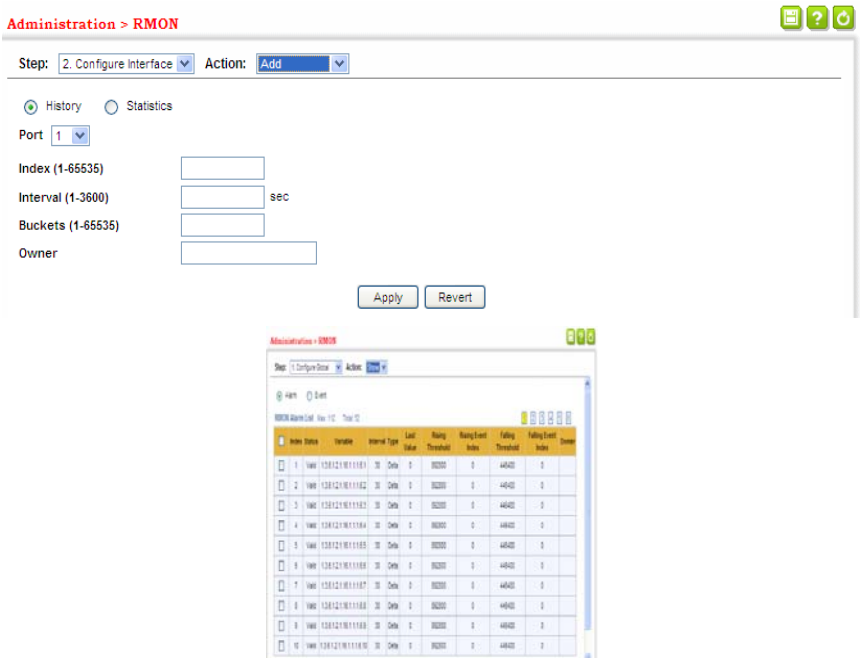
Web Interface

To periodically sample statistics on a port:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE INTERFACE from the STEP list.

3. Select ADD from the ACTION list.
4. Click HISTORY.
5. Select a port from the list as the data source.
6. Enter an index number, the sampling interval, the number of buckets to use, and the name of the owner for this entry.
7. Click APPLY.

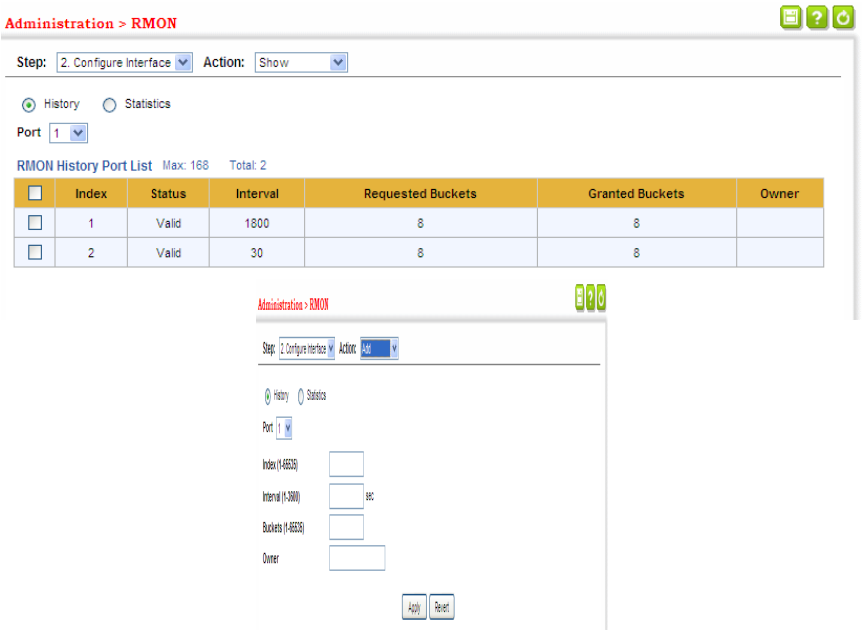
Figure 15-43. Configuring an RMON History Sample



To show configured RMON history samples:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select SHOW from the ACTION list.
4. Select a port from the list.
5. Click HISTORY.

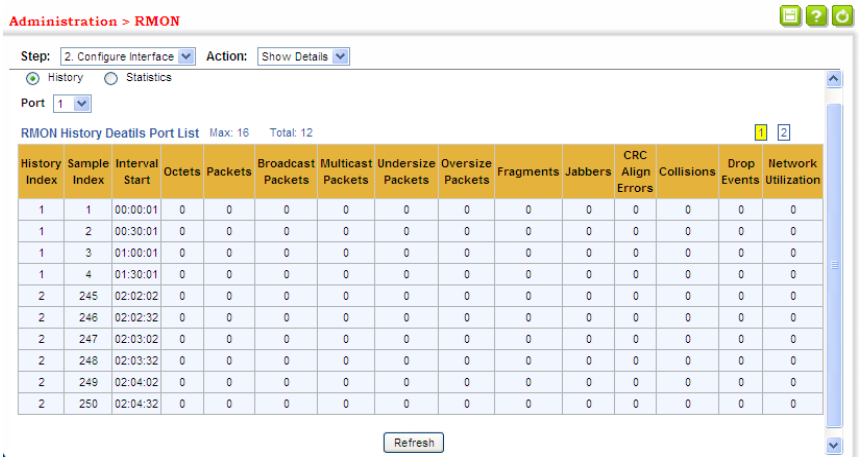
Figure 15-44. Showing Configured RMON History Samples



To show collected RMON history samples:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select SHOW DETAILS from the ACTION list.
4. Select a port from the list.
5. Click HISTORY.

Figure 15-45. Showing Collected RMON History Samples


Administration > RMON
Step: 2. Configure Interface Action: Show Details
History Statistics
Port 1
RMON History Deatils Port List Max: 16 Total: 12
1 2
History Index | Sample Index | Interval Start | Octets | Packets | Broadcast Packets | Multicast Packets | Undersize Packets | Oversize Packets | Fragments | Jabbers | CRC Align Errors | Collisions | Drop Events | Network Utilization
1 | 1 | 00:00:01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
1 | 2 | 00:30:01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
1 | 3 | 01:00:01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
1 | 4 | 01:30:01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 245 | 02:02:02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 246 | 02:02:32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 247 | 02:03:02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 248 | 02:03:32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 249 | 02:04:02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 250 | 02:04:32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
Refresh

Configuring RMON Statistical Samples

Use the ADMINISTRATION > RMON (CONFIGURE INTERFACE - ADD - STATISTICS) page to collect statistics on a port, which can subsequently be used to monitor the network for common errors and overall traffic rates.

CLI References

See Chapter 23: "Remote Monitoring Commands" on page 23-1 for CLI reference information.

Command Usage

- If statistics collection is already enabled on an interface, the entry must be deleted before any changes can be made.
- The information collected for each entry includes:

  input octets, packets, broadcast packets, multicast packets, undersize packets, oversize packets, CRC alignment errors, jabbers, fragments, collisions, drop events, and frames of various sizes.

Parameters

These parameters are displayed in the web interface:

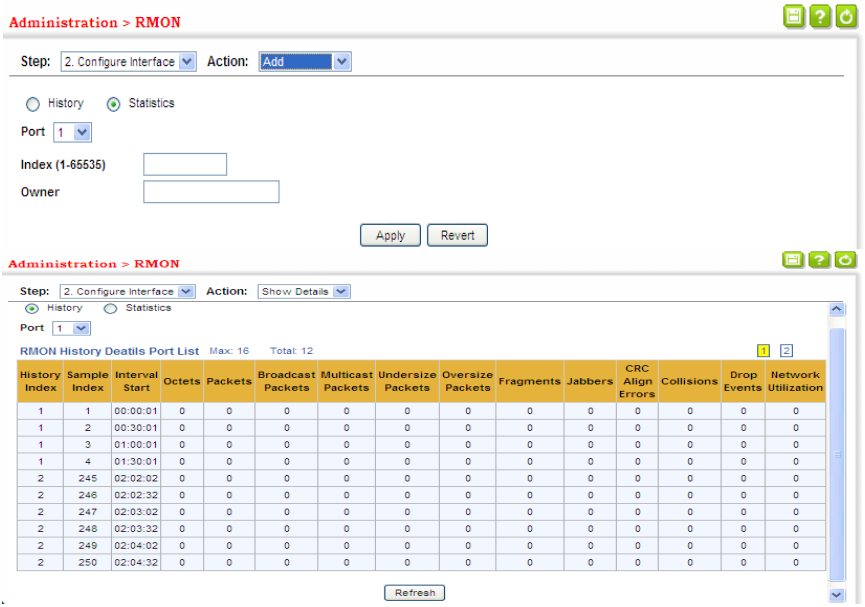
- **Port** – The port number on the switch.
- **Index** - Index to this entry. (Range: 1-65535)
- **Owner** - Name of the person who created this entry. (Range: 1-127 characters)

Web Interface

To enable regular sampling of statistics on a port:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select ADD from the ACTION list.
4. Click STATISTICS.
5. Select a port from the list as the data source.
6. Enter an index number, and the name of the owner for this entry
7. Click APPLY

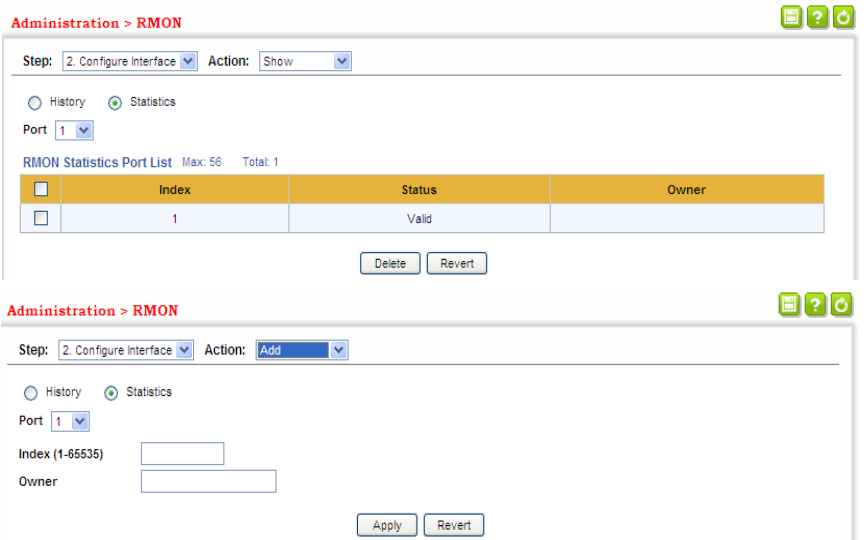
Figure 15-46. Configuring an RMON Statistical Sample


Administration > RMON
Step: 2. Configure Interface Action: Add
History Statistics
Port 1
Index (1-65535)
Owner
Apply Revert
Administration > RMON
Step: 2. Configure Interface Action: Show Details
History Statistics
Port 1
RMON History Deatils Port List Max: 16 Total: 12
History Index | Sample Index | Interval Start | Octets | Packets | Broadcast Packets | Multicast Packets | Undersize Packets | Oversize Packets | Fragments | Jabbers | CRC Align Errors | Collisions | Drop Events | Network Utilization
1 | 1 | 00:00:01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
1 | 2 | 00:30:01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
1 | 3 | 01:00:01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
1 | 4 | 01:30:01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 245 | 02:02:02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 246 | 02:02:32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 247 | 02:03:02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 248 | 02:03:32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 249 | 02:04:02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
2 | 250 | 02:04:32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0
Refresh

To show configured RMON statistical samples:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select SHOW from the ACTION list.
4. Select a port from the list.
5. Click STATISTICS.

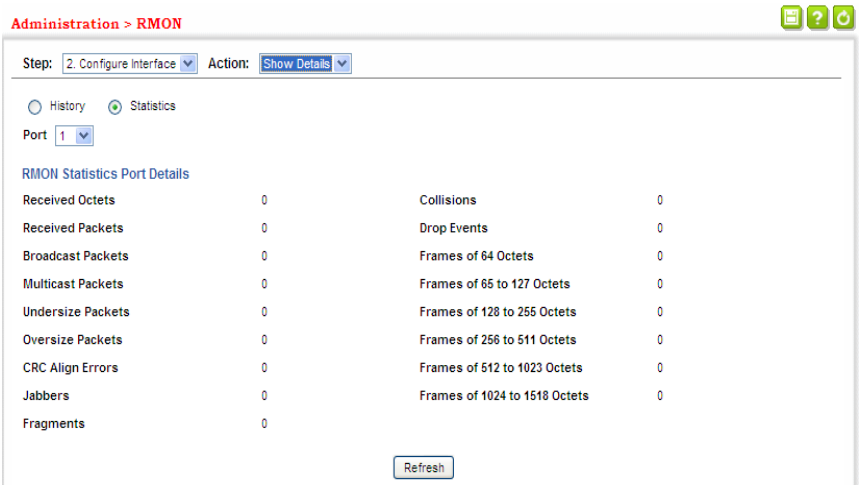
Figure 15-47. Showing Configured RMON Statistical Samples



To show collected RMON statistical samples:

1. Click ADMINISTRATION > RMON.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select SHOW DETAILS from the ACTION list.
4. Select a port from the list.
5. Click STATISTICS.

Figure 15-48. Showing Collected RMON Statistical Samples



15-6 Switch Clustering

Switch clustering is a method of grouping switches together to enable centralized management through a single unit. Switches that support clustering can be grouped together regardless of physical location or switch type, as long as they are connected to the same local network.

Command Usage

- A switch cluster has a "Commander" unit that is used to manage all other "Member" switches in the cluster. The management station can use either Telnet or the web interface to communicate directly with the Commander through its IP address, and then use the Commander to manage Member switches using the cluster's "internal" IP addresses.
- Clustered switches must be in the same Ethernet broadcast domain. In other words, clustering only functions for switches which can pass information between the Commander and potential Candidates or active Members through VLAN 4093.
- Once a switch has been configured to be a cluster Commander, it automatically discovers other cluster-enabled switches in the network. These "Candidate" switches only become cluster Members when manually selected by the administrator through the management station.
- There can be up to 100 candidates and 36 member switches in one cluster.
- A switch can only be a member of one cluster.

- The cluster VLAN 4093 is not configured by default. Before using clustering, take the following actions to set up this VLAN:

1. Create VLAN 4093 (see "Configuring VLAN Groups" on page 7-4).
2. Add the participating ports to this VLAN (see "Adding Static Members to VLANs" on page 7-6), and set them to hybrid mode, tagged members, PVID = 1, and acceptable frame type = all.

- After the Commander and Members have been configured, any switch in the cluster can be managed from the web agent by choosing the desired Member ID from the Show Member page.

Configuring General Settings for Clusters

Use the ADMINISTRATION > CLUSTER (CONFIGURE GLOBAL) page to create a switch cluster.

CLI References

See Section 21-10: "Switch Clustering" on page 21-64 for CLI reference information.

Command Usage

First be sure that clustering is enabled on the switch (the default is disabled), then set the switch as a Cluster Commander. Set a Cluster IP Pool that does not conflict with the network IP subnet. Cluster IP addresses are assigned to switches when they become Members and are used for communication between Member switches and the Commander.

Parameters

These parameters are displayed in the web interface:

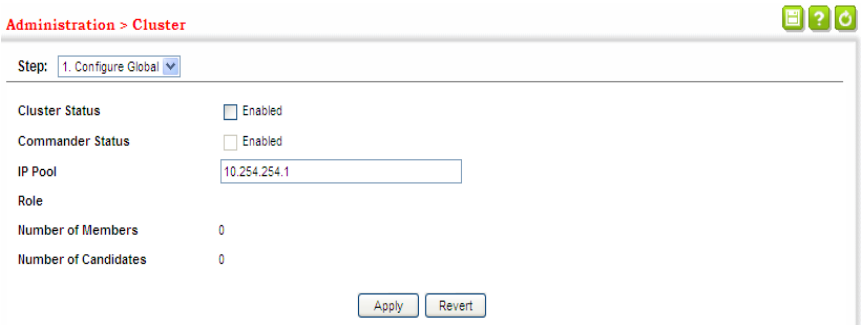
- **Cluster Status** – Enables or disables clustering on the switch. (Default: Disabled)
- **Commander Status** – Enables or disables the switch as a cluster Commander. (Default: Disabled)
- **IP Pool** – An “internal” IP address pool that is used to assign IP addresses to Member switches in the cluster. Internal cluster IP addresses are in the form 10.x.x.member-ID. Only the base IP address of the pool needs to be set since Member IDs can only be between 1 and 36. Note that you cannot change the cluster IP pool when the switch is currently in Commander mode. Commander mode must first be disabled. (Default: 10.254.254.1)
- **Role** – Indicates the current role of the switch in the cluster; either Commander, Member, or Candidate. (Default: Candidate)
- **Number of Members** – The current number of Member switches in the cluster.
- **Number of Candidates** – The current number of Candidate switches discovered in the network that are available to become Members.

Web Interface

To configure a switch cluster:

1. Click ADMINISTRATION > CLUSTER.
2. Select CONFIGURE GLOBAL from the STEP list.
3. Set the required attributes for a Commander or a managed candidate.
4. Click APPLY

Figure 15-49. Configuring a Switch Cluster



Cluster Member Configuration

Use the ADMINISTRATION > CLUSTER (CONFIGURE MEMBER - ADD) page to add Candidate switches to the cluster as Members.

CLI References

See Section 21-10: "Switch Clustering" on page 21-64 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Member ID** – Specify a Member ID number for the selected Candidate switch. (Range: 1-36)
- **MAC Address** – Select a discovered switch MAC address from the Candidate Table, or enter a specific MAC address of a known switch.

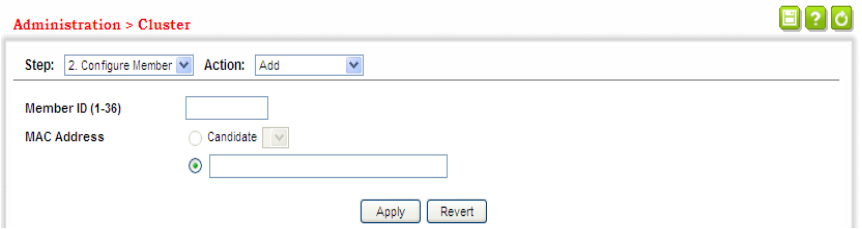
Web Interface

To configure cluster members:

1. Click ADMINISTRATION > CLUSTER.
2. Select CONFIGURE MEMBER from the STEP list.

3. Select ADD from the ACTION list.
4. Select one of the cluster candidates discovered by this switch, or enter the MAC address of a candidate.
5. Click APPLY.

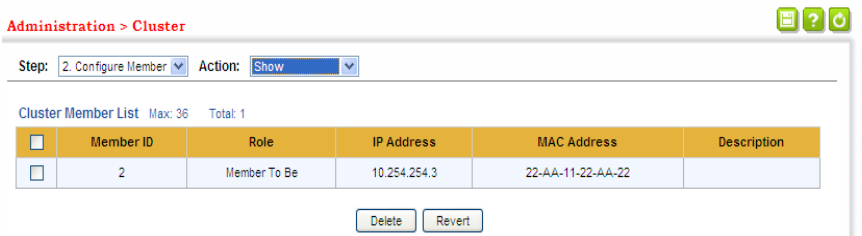
Figure 15-50. Configuring a Cluster Members



To show the cluster members:

1. Click ADMINISTRATION > CLUSTER.
2. Select CONFIGURE MEMBER from the STEP list.
3. Select SHOW from the ACTION list.

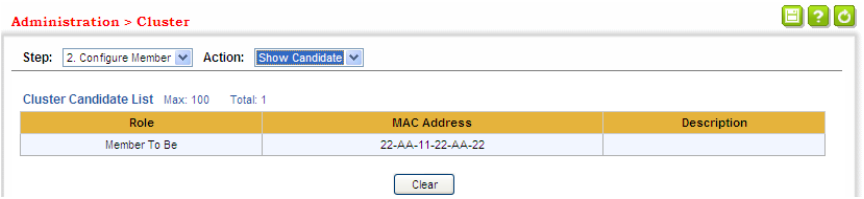
Figure 15-51. Showing Cluster Members



To show cluster candidates:

1. Click ADMINISTRATION > CLUSTER.
2. Select CONFIGURE MEMBER from the STEP list.
3. Select SHOW CANDIDATE from the ACTION list.

Figure 15-52. Showing Cluster Candidates



Managing Cluster Members

Use the ADMINISTRATION > CLUSTER (SHOW MEMBER) page to manage another switch in the cluster.

CLI References

See Section 21-10: "Switch Clustering" on page 21-64 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

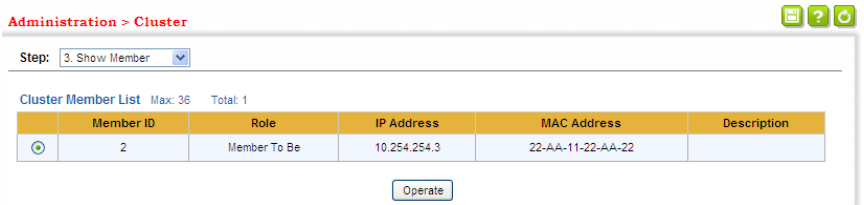
- **Member ID** – The ID number of the Member switch. (Range: 1-36)
- **Role** – Indicates the current status of the switch in the cluster.
- **IP Address** – The internal cluster IP address assigned to the Member switch.
- **MAC Address** – The MAC address of the Member switch.
- **Description** – The system description string of the Member switch.
- **Operate** – Remotely manage a cluster member.

Web Interface

To manage a cluster member:

1. Click ADMINISTRATION > CLUSTER.
2. Select SHOW MEMBER from the STEP list.
3. Select an entry from the CLUSTER MEMBER list.
4. Click OPERATE.

Figure 15-53. Managing a Cluster Member



15-7 Setting A Time Range

Use the ADMINISTRATION > TIME RANGE page to sets a time range during which various functions are applied, including applied ACLs or PoE.

CLI References

See Section 21-9: "Time Range" on page 21-59 for CLI reference information.

Command Usage

If both an absolute rule and one or more periodic rules are configured for the same time range (i.e., named entry), that entry will only take effect if the current time is within the absolute time range and one of the periodic time ranges.

Parameters

These parameters are displayed in the web interface:

Add

- **Time-Range Name** – Name of a time range. (Range: 1-16 characters)

Add Rule

- **Time-Range** – Name of a time range.
- **Mode**
  - **Absolute** – Specifies a specific time or time range.
  - **Start/End** – Specifies the hours, minutes, month, day, and year at which to start or end.
  - **Periodic** – Specifies a periodic interval.
  - **Start/To** – Specifies the days of the week, hours, and minutes at which to start or end.

Web Interface

To configure a time range:

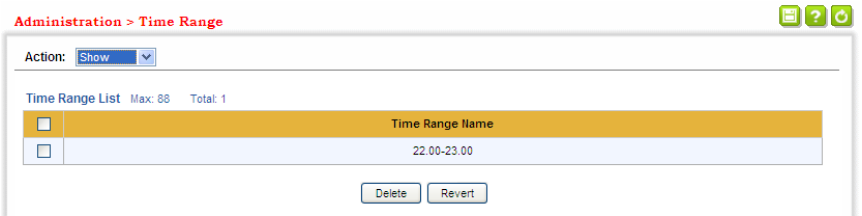
1. Click ADMINISTRATION > TIME RANGE.
2. Select ADD from the ACTION list.
3. Enter the name of a time range.
4. Click APPLY.

Figure 15-54. Setting the Name of a Time Range

To show a list of time ranges:

1. Click ADMINISTRATION > TIME RANGE.
2. Select SHOW from the ACTION list.

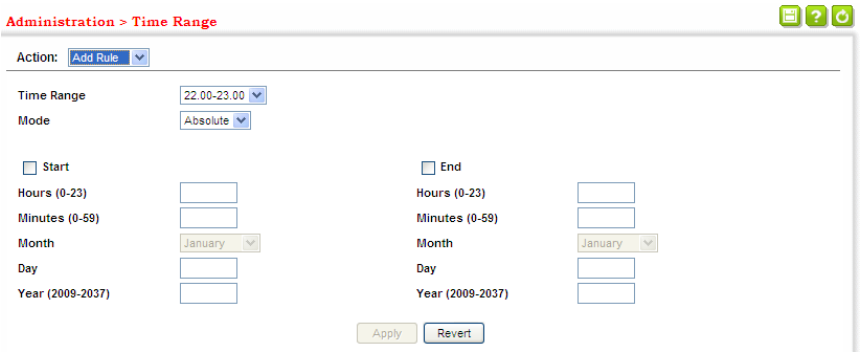
Figure 15-55. Showing a List of Time Ranges



To configure a rule for a time range:

1. Click ADMINISTRATION > TIME RANGE.
2. Select ADD RULE from the ACTION list.
3. Select the name of time range from the drop-down list.
4. Select a mode option of ABSOLUTE or PERIODIC.
5. Fill in the required parameters for the selected mode.
6. Click APPLY.

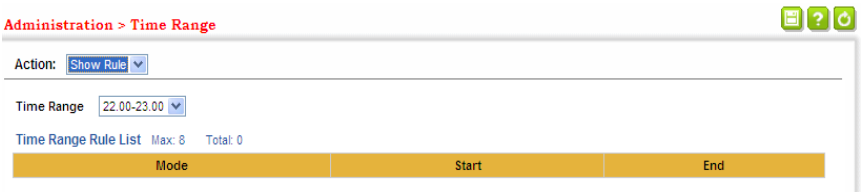
Figure 15-56. Add a Rule to a Time Range



To show the rules configured for a time range:

1. Click ADMINISTRATION > TIME RANGE.
2. Select SHOW RULE from the ACTION list.

Figure 15-57. Showing the Rules Configured for a Time Range



Chapter 16
IP Configuration

This chapter describes how to configure an IP interface for management access to the switch over the network. This switch supports both IP Version 4 and Version 6, and can be managed simultaneously through either of these address types. You can manually configure a specific IPv4 or IPv6 address or direct the switch to obtain an IPv4 address from a BOOTP or DHCP server when it is powered on. An IPv6 address can either be manually configured or dynamically generated.

This chapter provides information on network functions including:

- Using the Ping Function – Sends ping message to another node on the network.
- Address Resolution Protocol– Specifies the timeout for ARP cache entries. Also shows how to display the ARP cache.
- Setting the Switch's IP Address (IP Version 4) – Sets an IPv4 address for management access.
- Setting the Switch's IP Address (IP Version 6) – Sets an IPv6 address for management access.

16-1 Using the Ping Function

Use the IP > GENERAL > PING page to send ICMP echo request packets to another node on the network.

CLI References

See "ping" on page 42-7 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Host Name/IP Address** – Specifies the host name (that is, alias) or IP address of the target.

  For host name-to-IP address translation to function properly, host name lookup must be enabled (Section 17-1: "Configuring General DNS Service Parameters" on page 17-1), and one or more DNS servers specified (see Section 17-3: "Configuring a List of Name Servers" on page 17-4, or Section 17-4: "Configuring Static DNS Host to Address Entries" on page 17-5).

- **Probe Count** – Number of packets to send. (Range: 1-16)
- **Packet Size** – Number of bytes in a packet. (Range: 32-512 bytes)

  The actual packet size will be eight bytes larger than the size specified because the switch adds header information.

Command Usage

Use the ping command to see if another site on the network can be reached. The following are some results of the *ping* command:

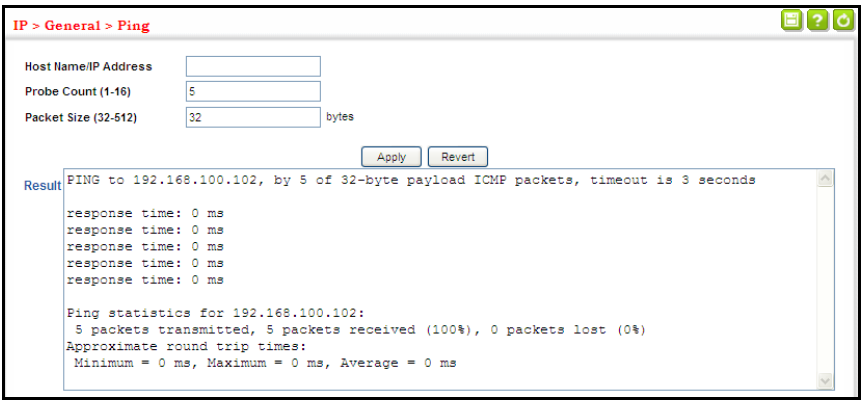
- **Normal response** – The normal response occurs in one to ten seconds, depending on network traffic.
- **Destination does not respond** – If the host does not respond, a "timeout" appears in ten seconds.
- **Destination unreachable** – The gateway for this destination indicates that the destination is unreachable.
- **Network or host unreachable** – The gateway found no corresponding entry in the route table.

Web Interface

To ping another device on the network:

1. Click IP > GENERAL > PING.
2. Specify the target device and ping parameters.
3. Click APPLY.

Figure 16-1. Pinging a Network Device


IP > General > Ping
Host Name/IP Address
Probe Count (1-16)
5
Packet Size (32-512)
32
bytes
Apply
Revert
Result
PING to 192.168.100.102, by 5 of 32-byte payload ICMP packets, timeout is 3 seconds
response time: 0 ms
response time: 0 ms
response time: 0 ms
response time: 0 ms
response time: 0 ms
Ping statistics for 192.168.100.102:
5 packets transmitted, 5 packets received (100%), 0 packets lost (0%)
Approximate round trip times:
Minimum = 0 ms, Maximum = 0 ms, Average = 0 ms

16-2 Address Resolution Protocol

Address Resolution Protocol (ARP) is used to map an IP address to a physical layer (i.e., MAC) address. When a device sends or receives a packet with an IP header, it must first resolve the destination IP address into a MAC address. When an IP frame is received by this switch, it first looks up the MAC address corresponding to the destination IP address in the ARP cache. If the address is found, the switch writes the MAC address into the appropriate field in the frame header, and forwards the frame on to the destination.

If there is no entry for an IP address in the ARP cache, the switch will broadcast an ARP request packet to all devices on the network. The ARP request contains the following fields similar to that shown in this example:

Table 16-1. Address Resolution Protocol

destination IP address	10.1.0.19
destination MAC address	?
source IP address	10.1.0.253
source MAC address	00-00-ab-cd-00-00

When devices receive this request, they discard it if their address does not match the destination IP address in the message. However, if it does match, they write their own hardware address into the destination MAC address field and send the message back to the source hardware address. When the source device receives a reply, it writes the destination IP address and corresponding MAC address into its cache, and forwards the IP traffic on to the next hop. As long as this entry has not timed out, the switch will be able forward traffic directly to the next hop without having to broadcast another ARP request.

Also, if the switch receives a request for its own IP address, it will send back a response, and also cache the MAC of the source device's IP address.

Setting the ARP Timeout

Use the IP > ARP (CONFIGURE GENERAL) page to specify the timeout for ARP cache entries.

CLI References

See "arp timeout" on page 42-8 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Timeout** – Sets the aging time for dynamic entries in the ARP cache. (Range: 300 - 86400 seconds; Default: 1200 seconds or 20 minutes)

  The ARP aging timeout can only be set globally for all VLANs.

The aging time determines how long dynamic entries remain in the cache. If the timeout is too short, the switch may tie up resources by repeating ARP requests for addresses recently flushed from the table.

When a ARP entry expires, it is deleted from the cache and an ARP request packet is sent to re-establish the MAC address.

Web Interface

To configure the timeout for the ARP cache:

1. Click IP > ARP.
2. Select CONFIGURE GENERAL from the STEP List.
3. Set the timeout to a suitable value for the ARP cache.
4. Click APPLY.

Figure 16-2. Setting the ARP Timeout

Displaying ARP Entries

Use the IP > ARP (SHOW INFORMATION) page to display dynamic or local entries in the ARP cache. The ARP cache contains entries for local interfaces, including subnet, host, and broadcast addresses. However, most entries will be dynamically learned through replies to broadcast messages.

CLI References

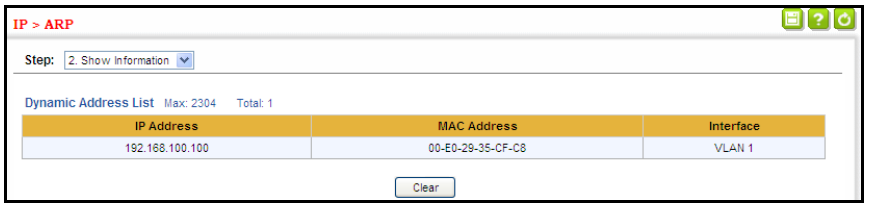
See "show arp" on page 42-10 and "clear arp-cache" on page 42-9 for CLI reference information.

Web Interface

To display entries in the ARP cache:

1. Click IP > ARP.
2. Select SHOW INFORMATION from the STEP List.

Figure 16-3. Displaying ARP Entries



16-3 Setting the Switch's IP Address (IP Version 4)

Use the SYSTEM > IP page to configure an IPv4 address for management access over the network. This switch supports both IPv4 and IPv6, and can be managed through either of these address types. For information on configuring the switch with an IPv6 address, see Section 16-4: "Setting the Switch's IP Address (IP Version 6)" on page 16-7.

You can direct the device to obtain an address from a BOOTP or DHCP server, or manually configure a static IP address. Valid IP addresses consist of four decimal numbers, 0 to 255, separated by periods. Anything other than this format will not be accepted.

A static address of 192.168.100.102 is set by default for VLAN 1. To configure an address compatible with your network, you need to change the switch's default settings. You may also need to a establish a default gateway between the switch and management stations that exist on another network segment.

CLI References

See Section 41-1: "DHCP Client" on page 41-1 and "Basic IPv4 Configuration" on page 42-2 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Management VLAN** – ID of the configured VLAN (1-4093). By default, all ports on the switch are members of VLAN 1. However, the management station can be attached to a port belonging to any VLAN, as long as that VLAN has been assigned an IP address.
- **IP Address Mode** – Specifies whether IP functionality is enabled via manual configuration (Static), Dynamic Host Configuration Protocol (DHCP), or Boot Protocol (BOOTP). If DHCP/BOOTP is enabled, IP will not function until a reply has been received from the server. Requests will be broadcast periodically by the switch for an IP address. DHCP/BOOTP responses can include the IP address, subnet mask, and default gateway. (Default: Static)

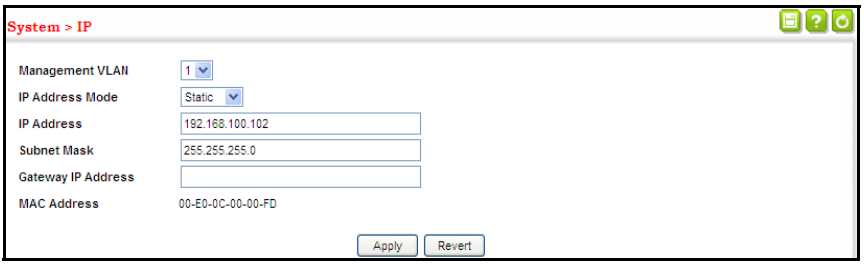
- **IP Address** – Address of the VLAN to which the management station is attached. Valid IP addresses consist of four numbers, 0 to 255, separated by periods. (Default: 192.168.100.102)
- **Subnet Mask** – This mask identifies the host address bits used for routing to specific subnets. (Default: 255.255.255.0)
- **Gateway IP Address** – IP address of the gateway router between the switch and management stations that exist on other network segments. (Default: 0.0.0.0)
- **MAC Address** – The physical layer address for this switch.
- **Restart DHCP** – Requests a new IP address from the DHCP server.

Web Interface

To set a static address for the switch:

1. Click SYSTEM > IP.
2. Select the VLAN through which the management station is attached, set the IP ADDRESS MODE to "STATIC," enter the IP address, subnet mask and gateway.
3. Click APPLY.

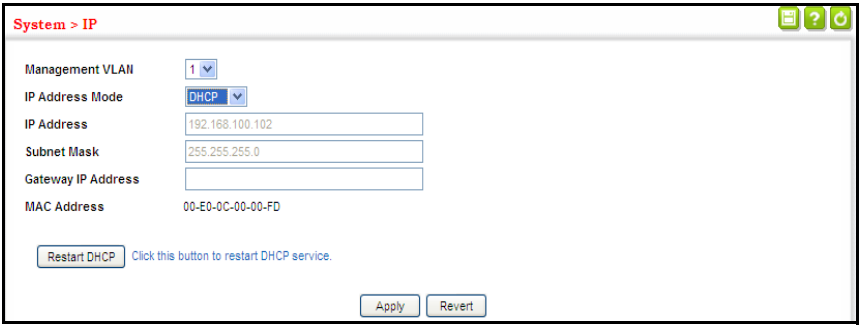
Figure 16-4. Configuring a Static IPv4 Address



To obtain an dynamic address through DHCP/BOOTP for the switch:

1. Click SYSTEM > IP.
2. Select the VLAN through which the management station is attached, set the IP ADDRESS MODE to "DHCP" or "BOOTP."
3. Click APPLY to save your changes.
4. Then click RESTART DHCP to immediately request a new address.

Figure 16-5. Configuring a Dynamic IPv4 Address



NOTE: The switch will also broadcast a request for IP configuration settings on each power reset.

NOTE: If you lose the management connection, make a console connection to the switch and enter “show ip interface” to determine the new switch address.

NOTE: Renewing DHCP – DHCP may lease addresses to clients indefinitely or for a specific period of time. If the address expires or the switch is moved to another network segment, you will lose management access to the switch. In this case, you can reboot the switch or submit a client request to restart DHCP service via the CLI.

If the address assigned by DHCP is no longer functioning, you will not be able to renew the IP settings via the web interface. You can only restart DHCP service via the web interface if the current address is still available.

16-4 Setting the Switch’s IP Address (IP Version 6)

This section describes how to configure an IPv6 interface for management access over the network. This switch supports both IPv4 and IPv6, and can be managed through either of these address types. For information on configuring the switch with an IPv4 address, see Section 16-3: "Setting the Switch’s IP Address (IP Version 4)" on page 16-5.

Command Usage

IPv6 includes two distinct address types – link-local unicast and global unicast. A link-local address makes the switch accessible over IPv6 for all devices attached to the same local subnet. Management traffic using this kind of address cannot be passed by any router outside of the subnet. A link-local address is easy to set up, and may be useful for simple networks or basic troubleshooting tasks. However, to connect to a larger network with multiple segments, the switch must be configured with a global unicast address. Both link-local and global unicast address types can either be dynamically assigned (using the Configure Interface page) or manually configured (using the ADD IPV6 ADDRESS page).

Configuring the IPv6 Default Gateway

Use the IP > IPV6 CONFIGURATION (CONFIGURE GLOBAL) page to configure an IPv6 default gateway for the switch.

CLI References

See "ipv6 default-gateway" on page 42-12 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Default Gateway** – Sets the IPv6 address of the default next hop router.
  - An IPv6 default gateway must be defined if the management station is located in a different IPv6 segment.
  - An IPv6 default gateway can only be successfully set when a network interface that directly connects to the gateway has been configured on the switch.

Web Interface

To configure an IPv6 default gateway for the switch:

1. Click IP > IPV6 CONFIGURATION.
2. Select CONFIGURE GLOBAL from the ACTION list.
3. Enter the IPv6 default gateway.
4. Click APPLY.

Figure 16-6. Configuring the IPv6 Default Gateway

Configuring IPv6 Interface Settings

Use the IP > IPv6 CONFIGURATION (CONFIGURE INTERFACE) page to configure general IPv6 settings for the selected VLAN, including auto-configuration of a global unicast interface address, and explicit configuration of a link local interface address.

CLI References

See Section 42-2: "IPv6 Interface" on page 42-11 and Section 41-1: "DHCP Client" on page 41-1 for CLI reference information.

Command Usage

- The switch must always be configured with a link-local address. The switch's address auto-configuration function will automatically create a link-local address, as well as an IPv6 global address if router advertisements are detected on the local interface.
- The option to explicitly enable IPv6 will also create a link-local address, but will not generate a global IPv6 address if auto-configuration is not enabled. In this case, you must manually configure an address (see "Configuring an IPv6 Address" on page 16-10).

Parameters

These parameters are displayed in the web interface:

- **VLAN** – ID of a configured VLAN which is to be used for management access. By default, all ports on the switch are members of VLAN 1. However, the management station can be attached to a port belonging to any VLAN, as long as that VLAN has been assigned an IP address. (Range: 1-4093)
- **Address Autoconfig** – Enables stateless autoconfiguration of IPv6 addresses on an interface and enables IPv6 functionality on that interface. The network portion of the address is based on prefixes received in IPv6 router advertisement messages, and the host portion is automatically generated using the modified EUI-64 form of the interface identifier (i.e., the switch's MAC address).
  - If the router advertisements have the "other stateful configuration" flag set, the switch will attempt to acquire other non-address configuration information (such as a default gateway).

- If auto-configuration is not selected, then an address must be manually configured using the Add Interface page described below.

- **Enable IPv6 Explicitly** – Enables IPv6 on an interface. Note that when an explicit address is assigned to an interface, IPv6 is automatically enabled, and cannot be disabled until all assigned addresses have been removed. (Default: Disabled)

  Disabling this parameter does not disable IPv6 for an interface that has been explicitly configured with an IPv6 address.

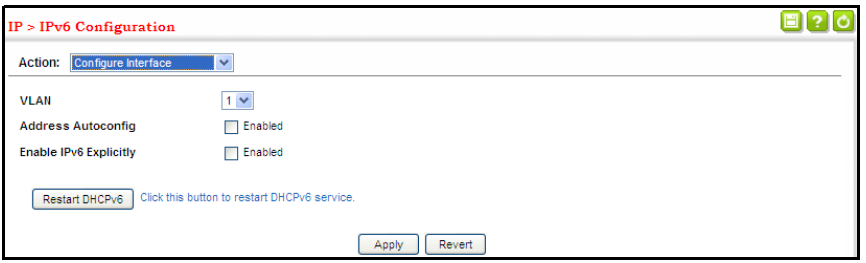
NOTE: Restart DHCPv6 – DHCPv6 stateful configuration of IP address prefixes is not supported in the current software release. If the router advertisements have the "other stateful configuration" flag set, the switch will attempt to acquire other non-address configuration information (such as a default gateway) from a DHCPv6 server.

Web Interface

To general IPv6 settings for the switch:

1. Click IP > IPv6 CONFIGURATION.
2. Select CONFIGURE INTERFACE from the ACTION list.
3. Specify the VLAN to configure, enable address auto-configuration, or enable IPv6 explicitly to automatically configure a link-local address and enable IPv6 on the selected interface. Set the MTU size, the maximum number of duplicate address detection messages, and the neighbor solicitation message interval.
4. Click APPLY.

Figure 16-7. Configuring General Settings for an IPv6 Interface



Configuring an IPv6 Address

Use the IP > IPv6 CONFIGURATION (ADD IPV6 ADDRESS) page to configure an IPv6 interface for management access over the network.

CLI References

See Section 42-2: "IPv6 Interface" on page 42-11 for CLI reference information.

Command Usage

- All IPv6 addresses must be formatted according to RFC 2373 “IPv6 Addressing Architecture,” using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.
- The switch must always be configured with a link-local address. Therefore any configuration process that enables IPv6 functionality, or assigns a global unicast address to the switch, including address auto-configuration or explicitly enabling IPv6 (see "Configuring IPv6 Interface Settings" on page 16-9), will also automatically generate a link-local unicast address. The prefix length for a link-local address is fixed at 64 bits, and the host portion of the default address is based on the modified EUI-64 (Extended Universal Identifier) form of the interface identifier (i.e., the physical MAC address). Alternatively, you can manually configure the link-local address by entering the full address with the network prefix FE80.
- To connect to a larger network with multiple subnets, you must configure a global unicast address. There are several alternatives to configuring this address type:
  - The global unicast address can be automatically configured by taking the network prefix from router advertisements observed on the local interface, and using the modified EUI-64 form of the interface identifier to automatically create the host portion of the address (see "Configuring IPv6 Interface Settings" on page 16-9).
  - It can be manually configured by specifying the entire network prefix and prefix length, and using the EUI-64 form of the interface identifier to automatically create the low-order 64 bits in the host portion of the address.
  - You can also manually configure the global unicast address by entering the full address and prefix length.
- You can configure multiple IPv6 global unicast addresses per interface, but only one link-local address per interface.
- If a duplicate link-local address is detected on the local segment, this interface is disabled and a warning message displayed on the console. If a duplicate global unicast address is detected on the network, the address is disabled on this interface and a warning message displayed on the console.
- When an explicit address is assigned to an interface, IPv6 is automatically enabled, and cannot be disabled until all assigned addresses have been removed.

Parameters

These parameters are displayed in the web interface:

- **VLAN** – ID of a configured VLAN which is to be used for management access. By default, all ports on the switch are members of VLAN 1. However, the management station can be attached to a port belonging to any VLAN, as long as that VLAN has been assigned an IP address. (Range: 1-4093)
- **Address Type** – Defines the address type configured for this interface.

- **Global** – Configures an IPv6 global unicast address with a full IPv6 address including the network prefix and host address bits, followed by a forward slash, and a decimal value indicating how many contiguous bits (from the left) of the address comprise the prefix (i.e., the network portion of the address).
- **EUI-64 (Extended Universal Identifier)** – Configures an IPv6 address for an interface using an EUI-64 interface ID in the low order 64 bits.

  When using EUI-64 format for the low-order 64 bits in the host portion of the address, the value entered in the IPv6 Address field includes the network portion of the address, and the prefix length indicates how many contiguous bits (starting at the left) of the address comprise the prefix (i.e., the network portion of the address). Note that the value specified in the IPv6 Address field may include some of the high-order host bits if the specified prefix length is less than 64 bits. If the specified prefix length exceeds 64 bits, then the bits used in the network portion of the address will take precedence over the interface identifier.

  IPv6 addresses are 16 bytes long, of which the bottom 8 bytes typically form a unique host identifier based on the device's MAC address. The EUI-64 specification is designed for devices that use an extended 8-byte MAC address. For devices that still use a 6-byte MAC address (also known as EUI-48 format), it must be converted into EUI-64 format by inverting the universal/local bit in the address and inserting the hexadecimal number FFFE between the upper and lower three bytes of the MAC address.

  For example, if a device had an EUI-48 address of 28-9F-18-1C-82-35, the global/local bit must first be inverted to meet EUI-64 requirements (i.e., 1 for globally defined addresses and 0 for locally defined addresses), changing 28 to 2A. Then the two bytes FFFE are inserted between the OUI (i.e., organizationally unique identifier, or company identifier) and the rest of the address, resulting in a modified EUI-64 interface identifier of 2A-9F-18-FF-FE-1C-82-35.

  This host addressing method allows the same interface identifier to be used on multiple IP interfaces of a single device, as long as those interfaces are attached to different subnets.
- **Link Local** – Configures an IPv6 link-local address.
  - The address prefix must be FE80.
  - You can configure only one link-local address per interface.
  - The specified address replaces a link-local address that was automatically generated for the interface.

- **IPv6 Address** – IPv6 address assigned to this interface.

Web Interface

To configure an IPv6 address:

1. Click IP > IPv6 CONFIGURATION.
2. Select ADD IPV6 ADDRESS from the ACTION list.

3. Specify the VLAN to configure, select the address type, and then enter an IPv6 address and prefix length.
4. Click APPLY.

Figure 16-8. Configuring an IPv6 Address

Showing IPv6 Addresses

Use the IP > IPV6 CONFIGURATION (SHOW IPV6 ADDRESS) page to display the IPv6 addresses assigned to an interface.

CLI References

See "show ipv6 interface" on page 42-21 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **VLAN** – ID of a configured VLAN which is to be used for management access. By default, all ports on the switch are members of VLAN 1. However, the management station can be attached to a port belonging to any VLAN, as long as that VLAN has been assigned an IP address. (Range: 1-4093)
- **IP Address Type** – The address type (Global, EUI-64, Link Local).
- **IP Address** – An IPv6 address assigned to this interface.

  In addition to the unicast addresses assigned to an interface, a host is also required to listen to the all-nodes multicast addresses FF01::1 (interface-local scope) and FF02::1 (link-local scope).

  FF01::1/16 is the transient interface-local multicast address for all attached IPv6 nodes, and FF02::1/16 is the link-local multicast address for all attached IPv6 nodes. The interface-local multicast address is only used for loopback transmission of multicast traffic. Link-local multicast addresses cover the same types as used by link-local unicast addresses, including all nodes (FF02::1), all routers (FF02::2), and solicited nodes (FF02::1:FFXX:XXXX) as described below.

A node is also required to compute and join the associated solicited-node multicast addresses for every unicast and anycast address it is assigned. IPv6 addresses that differ only in the high-order bits, e.g. due to multiple high-order prefixes associated with different aggregations, will map to the same solicited-node address, thereby reducing the number of multicast addresses a node must join. In this example, FF02::1:FF90:0/104 is the solicited-node multicast address which is formed by taking the low-order 24 bits of the address and appending those bits to the prefix.

Note that the solicited-node multicast address (link-local scope FF02) is used to resolve the MAC addresses for neighbor nodes since IPv6 does not support the broadcast method used by the Address Resolution Protocol in IPv4.

These additional addresses are displayed by the CLI (see "show ip interface" on page 42-5).

- **Configuration Mode** – Indicates if this address was automatically generated for manually configured.

Web Interface

To show the configured IPv6 addresses:

1. Click IP > IPv6 CONFIGURATION.
2. Select SHOW IPV6 ADDRESS from the ACTION list.
3. Select a VLAN from the list.

Figure 16-9. Showing Configured IPv6 Addresses

Showing the IPv6 Neighbor Cache

Use the IP > IPV6 CONFIGURATION (SHOW IPV6 NEIGHBOR CACHE) page to display the IPv6 addresses detected for neighbor devices.

CLI References

See "show ipv6 neighbors" on page 42-30 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

Table 16-2. Show IPv6 Neighbors - display description

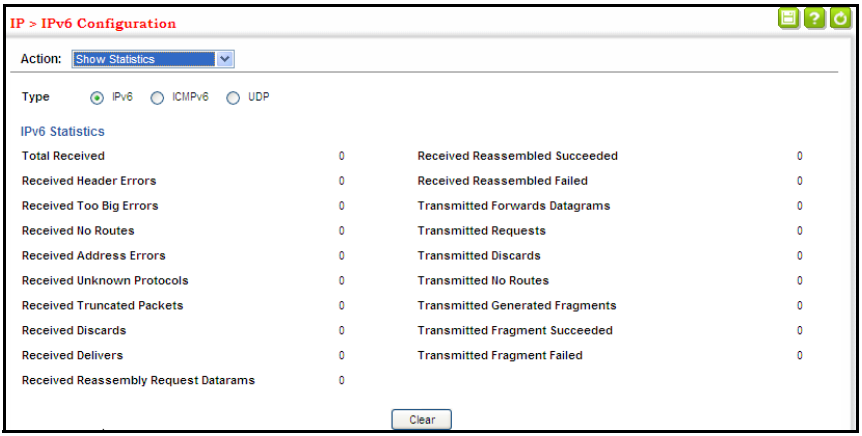
Field	Description
IPv6 Address	IPv6 address of neighbor
Age	The time since the address was verified as reachable (in seconds). A static entry is indicated by the value “Permanent.”
Link-layer Addr	Physical layer MAC address.
State	The following states are used for dynamic entries: INCMP (Incomplete) - Address resolution is being carried out on the entry. A neighbor solicitation message has been sent to the multicast address of the target, but it has not yet returned a neighbor advertisement message. REACH (Reachable) - Positive confirmation was received within the last ReachableTime interval that the forward path to the neighbor was functioning. While in REACH state, the device takes no special action when sending packets. STALE - More than the ReachableTime interval has elapsed since the last positive confirmation was received that the forward path was functioning. While in STALE state, the device takes no action until a packet is sent. DELAY - More than the ReachableTime interval has elapsed since the last positive confirmation was received that the forward path was functioning. A packet was sent within the last DELAY_FIRST_PROBE_TIME interval. If no reachability confirmation is received within this interval after entering the DELAY state, the switch will send a neighbor solicitation message and change the state to PROBE. PROBE - A reachability confirmation is actively sought by resending neighbor solicitation messages every RetransTimer interval until confirmation of reachability is received. UNKNO - Unknown state. The following states are used for static entries: INCMP (Incomplete)-The interface for this entry is down. REACH (Reachable) - The interface for this entry is up. Reachability detection is not applied to static entries in the IPv6 neighbor discovery cache.
VLAN	VLAN interface from which the address was reached.

Web Interface

To show neighboring IPv6 devices:

1. Click IP > IPv6 CONFIGURATION.
2. Select SHOW IPV6 NEIGHBORS from the ACTION list.

Figure 16-10. Showing IPv6 Neighbors



Showing IPv6 Statistics

Use the IP > IPv6 CONFIGURATION (SHOW STATISTICS) page to display statistics about IPv6 traffic passing through this switch.

CLI References

See "show ipv6 traffic" on page 42-23 for CLI reference information.

Command Usage

This switch provides statistics for the following traffic types:

- **IPv6** – The Internet Protocol for Version 6 addresses provides a mechanism for transmitting blocks of data (often called packets or frames) from a source to a destination, where these network devices (that is, hosts) are identified by fixed length addresses. The Internet Protocol also provides for fragmentation and reassembly of long packets, if necessary, for transmission through "small packet" networks.
- **ICMPv6** – Internet Control Message Protocol for Version 6 addresses is a network layer protocol that transmits message packets to report errors in processing IPv6 packets. ICMP is therefore an integral part of the Internet Protocol. ICMP messages may be used to report various situations, such as when a datagram cannot reach its destination, when the gateway does not have the buffering capacity to forward a datagram, and when the gateway can direct the host to send traffic on a shorter route. ICMP is also used by routers to feed back information about more suitable routes (that is, the next hop router) to use for a specific destination.

- **UDP** – User Datagram Protocol provides a datagram mode of packet switched communications. It uses IP as the underlying transport mechanism, providing access to IP-like services. UDP packets are delivered just like IP packets – connection-less datagrams that may be discarded before reaching their targets. UDP is useful when TCP would be too complex, too slow, or just unnecessary.

Parameters

These parameters are displayed in the web interface:

Table 16-3. Show IPv6 Statistics - Display Description

Field	Description
IPv6 Statistics	
IPv6 Received	
Total	The total number of input datagrams received by the interface, including those received in error.
Header Errors	The number of input datagrams discarded due to errors in their IPv6 headers, including version number mismatch, other format errors, hop count exceeded, IPv6 options, etc.
Too Big Errors	The number of input datagrams that could not be forwarded because their size exceeded the link MTU of outgoing interface.
No Routes	The number of input datagrams discarded because no route could be found to transmit them to their destination.
Address Errors	The number of input datagrams discarded because the IPv6 address in their IPv6 header's destination field was not a valid address to be received at this entity. This count includes invalid addresses (e.g., ::0) and unsupported addresses (e.g., addresses with unallocated prefixes). For entities which are not IPv6 routers and therefore do not forward datagrams, this counter includes datagrams discarded because the destination address was not a local address.
Unknown Protocols	The number of locally-addressed datagrams received successfully but discarded because of an unknown or unsupported protocol. This counter is incremented at the interface to which these datagrams were addressed which might not be necessarily the input interface for some of the datagrams.
Truncated Packets	The number of input datagrams discarded because datagram frame didn't carry enough data.
Discards	The number of input IPv6 datagrams for which no problems were encountered to prevent their continued processing, but which were discarded (e.g., for lack of buffer space). Note that this counter does not include any datagrams discarded while awaiting re-assembly.
Delivers	The total number of datagrams successfully delivered to IPv6 user-protocols (including ICMP). This counter is incremented at the interface to which these datagrams were addressed which might not be necessarily the input interface for some of the datagrams.

Table 16-3. Show IPv6 Statistics - Display Description (Continued)

Field	Description
Reassembly Request Datagrams	The number of IPv6 fragments received which needed to be reassembled at this interface. Note that this counter is increment ed at the interface to which these fragments were addressed which might not be necessarily the input interface for some of the fragments.
Reassembled Succeeded	The number of IPv6 datagrams successfully reassembled. Note that this counter is incremented at the interface to which these datagrams were addressed which might not be necessarily the input interface for some of the fragments.
Reassembled Failed	The number of failures detected by the IPv6 re-assembly algorithm (for whatever reason: timed out, errors, etc.). Note that this is not necessarily a count of discarded IPv6 fragments since some algorithms (notably the algorithm in RFC 815) can lose track of the number of fragments by combining them as they are received. This counter is incremented at the interface to which these fragments were addressed which might not be necessarily the input interface for some of the fragments.
IPv6 Transmitted	
Forwards Datagrams	The number of output datagrams which this entity received and forwarded to their final destinations. In entities which do not act as IPv6 routers, this counter will include only those packets which were Source-Routed via this entity, and the Source-Route processing was successful. Note that for a successfully forwarded datagram the counter of the outgoing interface is incremented."
Requests	The total number of IPv6 datagrams which local IPv6 user-protocols (including ICMP) supplied to IPv6 in requests for transmission. Note that this counter does not include any datagrams counted in ipv6IfStatsOutForwDatagrams.
Discards	The number of output IPv6 datagrams for which no problem was encountered to prevent their transmission to their destination, but which were discarded (e.g., for lack of buffer space). Note that this counter would include datagrams counted in ipv6IfStatsOutForwDatagrams if any such packets met this (discretionary) discard criterion.
No Routes	The number of input datagrams discarded because no route could be found to transmit them to their destination.
Generated Fragments	The number of output datagram fragments that have been generated as a result of fragmentation at this output interface.
Fragment Succeeded	The number of IPv6 datagrams that have been successfully fragmented at this output interface.
Fragment Failed	The number of IPv6 datagrams that have been discarded because they needed to be fragmented at this output interface but could not be.

Table 16-3. Show IPv6 Statistics - Display Description (Continued)

Field	Description
ICMPv6 Statistics	
ICMPv6 received	
Input	The total number of ICMP messages received by the interface which includes all those counted by ipv6IfIcmpInErrors. Note that this interface is the interface to which the ICMP messages were addressed which may not be necessarily the input interface for the messages.
Errors	The number of ICMP messages which the interface received but determined as having ICMP-specific errors (bad ICMP checksums, bad length, etc.).
Destination Unreachable Messages	The number of ICMP Destination Unreachable messages received by the interface.
Packet Too Big Messages	The number of ICMP Packet Too Big messages received by the interface.
Time Exceeded Messages	The number of ICMP Time Exceeded messages received by the interface.
Parameter Problem Messages	The number of ICMP Parameter Problem messages received by the interface.
Echo Request Messages	The number of ICMP Echo (request) messages received by the interface.
Echo Reply Messages	The number of ICMP Echo Reply messages received by the interface.
Redirect Messages	The number of Redirect messages received by the interface.
Group Membership Query Messages	The number of ICMPv6 Group Membership Query messages received by the interface.
Group Membership Response Messages	The number of ICMPv6 Group Membership Response messages received by the interface.
Group Membership Reduction Messages	The number of ICMPv6 Group Membership Reduction messages received by the interface.
Router Solicit Messages	The number of ICMP Router Solicit messages received by the interface.
Router Advertisement Messages	The number of ICMP Router Advertisement messages received by the interface.
Neighbor Solicit Messages	The number of ICMP Neighbor Solicit messages received by the interface.
Neighbor Advertisement Messages	The number of ICMP Neighbor Advertisement messages received by the interface.
Redirect Messages	The number of Redirect messages received by the interface.

Table 16-3. Show IPv6 Statistics - Display Description (Continued)

Field	Description
ICMPv6 Transmitted	
Output	The total number of ICMP messages which this interface attempted to send. Note that this counter includes all those counted by icmpOutErrors.
Destination Unreachable Messages	The number of ICMP Destination Unreachable messages sent by the interface.
Packet Too Big Messages	The number of ICMP Packet Too Big messages sent by the interface.
Time Exceeded Messages	The number of ICMP Time Exceeded messages sent by the interface.
Parameter Problem Message	The number of ICMP Parameter Problem messages sent by the interface.
Echo Reply Messages	The number of ICMP Echo Reply messages sent by the interface.
Router Solicit Messages	The number of ICMP Router Solicitation messages sent by the interface.
Neighbor Advertisement Messages	The number of ICMP Router Advertisement messages sent by the interface.
Redirect Messages	The number of Redirect messages sent. For a host, this object will always be zero, since hosts do not send redirects.
Group Membership Response Messages	The number of ICMPv6 Group Membership Response messages sent.
Group Membership Reduction Messages	The number of ICMPv6 Group Membership Reduction messages sent.
UDP Statistics	
Input	The total number of UDP datagrams delivered to UDP users.
No Port Errors	The total number of received UDP datagrams for which there was no application at the destination port.
Other Errors	The number of received UDP datagrams that could not be delivered for reasons other than the lack of an application at the destination port.
Output	The total number of UDP datagrams sent from this entity.

Web Interface

To show the IPv6 statistics:

1. Click IP > IPv6 CONFIGURATION.
2. Select SHOW STATISTICS from the ACTION list.
3. Click IPv6, ICMPv6 or UDP.

Figure 16-11. Showing IPv6 Statistics (IPv6)

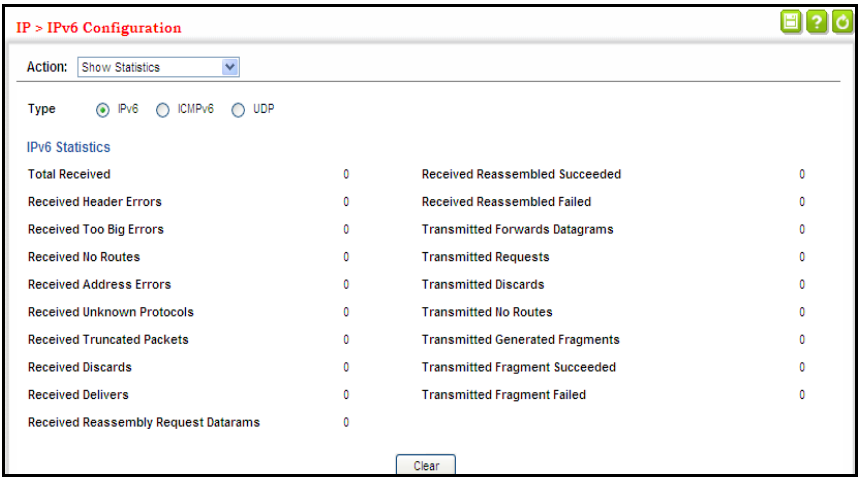


Figure 16-12. Showing IPv6 Statistics (ICMPv6)

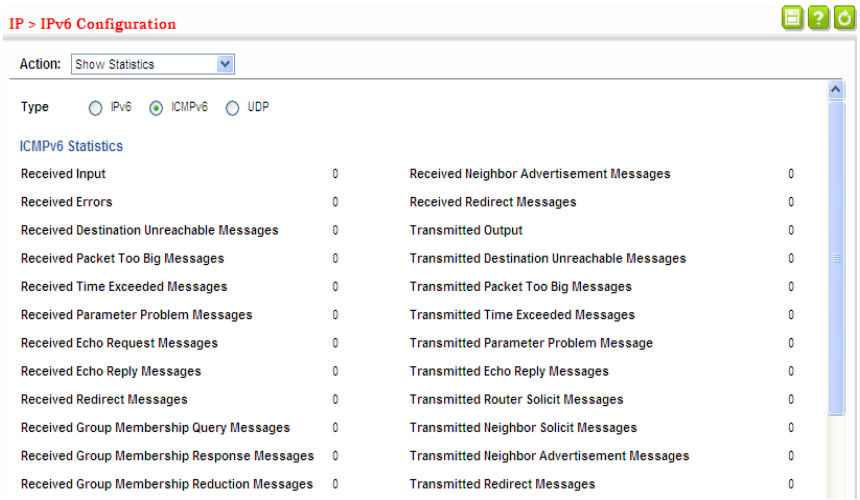
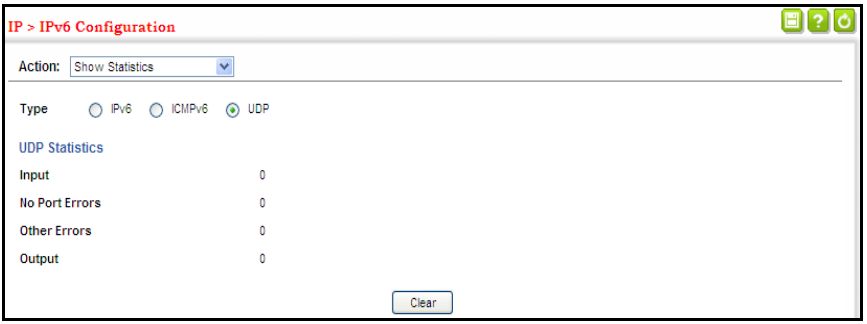

IP > IPv6 Configuration
Action: Show Statistics
Type IPv6 ICMPv6 UDP
ICMPv6 Statistics
Received Input 0
Received Errors 0
Received Destination Unreachable Messages 0
Received Packet Too Big Messages 0
Received Time Exceeded Messages 0
Received Parameter Problem Messages 0
Received Echo Request Messages 0
Received Echo Reply Messages 0
Received Redirect Messages 0
Received Group Membership Query Messages 0
Received Group Membership Response Messages 0
Received Group Membership Reduction Messages 0
Received Neighbor Advertisement Messages 0
Received Redirect Messages 0
Transmitted Output 0
Transmitted Destination Unreachable Messages 0
Transmitted Packet Too Big Messages 0
Transmitted Time Exceeded Messages 0
Transmitted Parameter Problem Message 0
Transmitted Echo Reply Messages 0
Transmitted Router Solicit Messages 0
Transmitted Neighbor Solicit Messages 0
Transmitted Neighbor Advertisement Messages 0
Transmitted Redirect Messages 0

Figure 16-13. Showing IPv6 Statistics (UDP)



Chapter 17
IP Services

This chapter describes how to configure Domain Name Service (DNS) on this switch. For information on DHCP snooping which is included in this folder, see Section 14-13: "DHCP Snooping" on page 14-89.

DNS service on this switch allows host names to be mapped to IP addresses using static table entries or by redirection to other name servers on the network. When a client device designates this switch as a DNS server, the client will attempt to resolve host names into IP addresses by forwarding DNS queries to the switch, and waiting for a response.

You can manually configure entries in the DNS table used for mapping domain names to IP addresses, configure default domain names, or specify one or more name servers to use for domain name to address translation.

17-1 Configuring General DNS Service Parameters

Use the IP SERVICE > DNS - GENERAL (CONFIGURE GLOBAL) page to enable domain lookup and set the default domain name.

CLI References

See "ip domain-lookup" on page 40-3 and "ip domain-name" on page 40-4 for CLI reference information.

Command Usage

To enable DNS service on this switch, enable domain lookup status, and configure one or more name servers (see Section 17-3: "Configuring a List of Name Servers" on page 17-4).

Parameters

These parameters are displayed in the web interface:

- **Domain Lookup** – Enables DNS host name-to-address translation. (Default: Disabled)
- **Default Domain Name** – Defines the default domain name appended to incomplete host names. Do not include the initial dot that separates the host name from the domain name (Range: 1-127 alphanumeric characters).

Web Interface

To configure general settings for DNS:

1. Click IP SERVICE > DNS.
2. Select CONFIGURE GLOBAL from the ACTION list.
3. Enable domain lookup, and set the default domain name.
4. Click APPLY.

Figure 17-1. Configuring General Settings for DNS

17-2 Configuring a List of Domain Names

Use the IP SERVICE > DNS - GENERAL (ADD DOMAIN NAME) page to configure a list of domain names to be tried in sequential order.

CLI References

See "ip domain-list" on page 40-2 and "show dns" on page 40-8 for CLI reference information.

Command Usage

- Use this page to define a list of domain names that can be appended to incomplete host names (i.e., host names passed from a client that are not formatted with dotted notation).
- If there is no domain list, the default domain name is used (see Section 17-1: "Configuring General DNS Service Parameters" on page 17-1). If there is a domain list, the system will search it for a corresponding entry. If none is found, it will use the default domain name.
- When an incomplete host name is received by the DNS service on this switch and a domain name list has been specified, the switch will work through the domain list, appending each domain name in the list to the host name, and checking with the specified name servers for a match (see Section 17-3: "Configuring a List of Name Servers" on page 17-4).

Parameters

These parameters are displayed in the web interface:

- **Domain Name** – Name of the host. Do not include the initial dot that separates the host name from the domain name.
  (Range: 1-68 characters)

Web Interface

To create a list domain names:

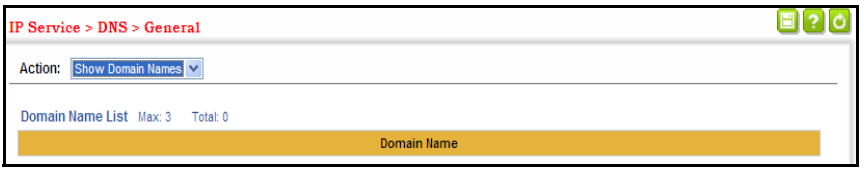
1. Click IP SERVICE > DNS.
2. Select ADD DOMAIN NAME from the ACTION list.
3. Enter one domain name at a time.
4. Click APPLY.

Figure 17-2. Configuring a List of Domain Names for DNS

To show the list domain names:

1. Click IP SERVICE > DNS.
2. Select SHOW DOMAIN NAMES from the ACTION list.

Figure 17-3. Showing the List of Domain Names for DNS



17-3 Configuring a List of Name Servers

Use the IP SERVICE > DNS - GENERAL (ADD NAME SERVER) page to configure a list of name servers to be tried in sequential order.

CLI References

See "ip name-server" on page 40-6 and "show dns" on page 40-8 for CLI reference information.

Command Usage

- To enable DNS service on this switch, configure one or more name servers, and enable domain lookup status (see Section 17-1: "Configuring General DNS Service Parameters" on page 17-1).
- When more than one name server is specified, the servers are queried in the specified sequence until a response is received, or the end of the list is reached with no response.
- If all name servers are deleted, DNS will automatically be disabled. This is done by disabling the domain lookup status.

Parameters

These parameters are displayed in the web interface:

- **Name Server IP Address** – Specifies the address of a domain name server to use for name-to-address resolution. Up to six IP addresses can be added to the name server list.

Web Interface

To create a list name servers:

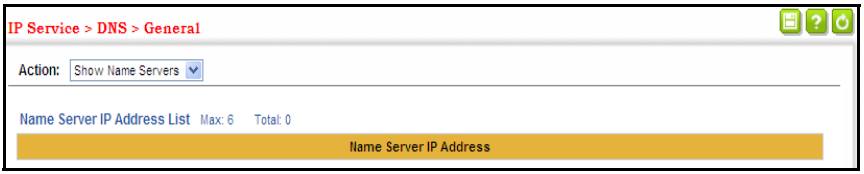
1. Click IP SERVICE > DNS.
2. Select ADD NAME SERVER from the ACTION list.
3. Enter one name server at a time.
4. Click APPLY.

Figure 17-4. Configuring a List of Name Servers for DNS

To show the list name servers:

1. Click IP SERVICE, DNS.
2. Select SHOW NAME SERVERS from the ACTION list.

Figure 17-5. Showing the List of Name Servers for DNS



17-4 Configuring Static DNS Host to Address Entries

Use the IP SERVICE > DNS - STATIC HOST TABLE (ADD) page to manually configure static entries in the DNS table that are used to map domain names to IP addresses.

CLI References

See "ip host" on page 40-5 and "show hosts" on page 40-10 for CLI reference information.

Command Usage

Static entries may be used for local devices connected directly to the attached network, or for commonly used resources located elsewhere on the network.

Parameters

These parameters are displayed in the web interface:

- **Host Name** – Name of a host device that is mapped to one or more IP addresses. (Range: 1-127 characters)
- **IP Address** – Internet address(es) associated with a host name.

Web Interface

To configure static entries in the DNS table:

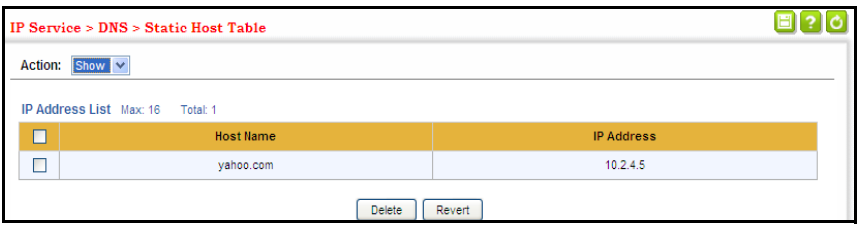
1. Click IP SERVICE > DNS - STATIC HOST TABLE.
2. Select ADD from the ACTION list.
3. Enter a host name and the corresponding address.
4. Click APPLY.

Figure 17-6. Configuring Static Entries in the DNS Table

To show static entries in the DNS table:

1. Click IP SERVICE > DNS - STATIC HOST TABLE.
2. Select SHOW from the ACTION list.

Figure 17-7. Showing Static Entries in the DNS Table



17-5 Displaying the DNS Cache

Use the IP SERVICE > DNS - CACHE page to display entries in the DNS cache that have been learned via the designated name servers.

CLI References

See "show dns cache" on page 40-9 for CLI reference information.

Command Usage

Servers or other network devices may support one or more connections via multiple IP addresses. If more than one IP address is associated with a host name via information returned from a name server, a DNS client can try each address in succession, until it establishes a connection with the target device.

Parameters

These parameters are displayed in the web interface:

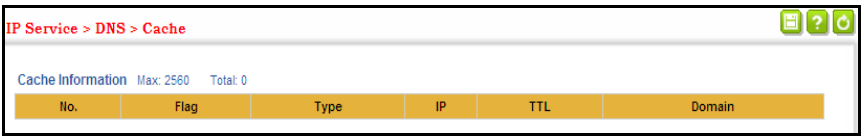
- **No.** – The entry number for each resource record.
- **Flag** – The flag is always "4" indicating a cache entry and therefore unreliable.

- **Type** – This field includes CNAME which specifies the host address for the owner, and ALIAS which specifies an alias.
- **IP** – The IP address associated with this record.
- **TTL** – The time to live reported by the name server.
- **Domain** – The domain name associated with this record.

Web Interface

To display entries in the DNS cache, simply click IP SERVICE > DNS - CACHE.

Figure 17-8. Showing Entries in the DNS Cache



Chapter 18
Multicast Filtering

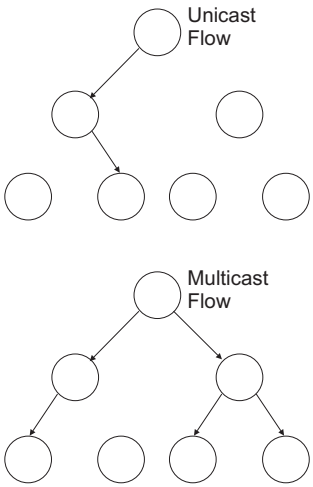
This chapter describes how to configure the following multicast services:

- Layer 2 IGMP (Snooping and Query) – Configuring snooping and query parameters.
- Filtering and Throttling IGMP Groups – Filtering specified multicast service, or throttling the maximum of multicast groups allowed on an interface.
- Multicast VLAN Registration – Configures a single network-wide multicast VLAN shared by hosts residing in other standard or private VLAN groups, preserving security and data isolation.

18-1 Overview

Multicasting is used to support real-time applications such as video conferencing or streaming audio. A multicast server does not have to establish a separate connection with each client. It merely broadcasts its service to the network, and any hosts that want to receive the multicast register with their local multicast switch/router. Although this approach reduces the network overhead required by a multicast server, the broadcast traffic must be carefully pruned at every multicast switch/router it passes through to ensure that traffic is only passed on to the hosts which subscribed to this service.

Figure 18-1. Multicast Filtering Concept



This switch can use Internet Group Management Protocol (IGMP) to filter multicast traffic. IGMP Snooping can be used to passively monitor or "snoop" on exchanges between attached hosts and an IGMP-enabled device, most commonly a multicast router. In this way, the switch can discover the ports that want to join a multicast group, and set its filters accordingly.

If there is no multicast router attached to the local subnet, multicast traffic and query messages may not be received by the switch. In this case (Layer 2) IGMP Query can be used to actively ask the attached hosts if they want to receive a specific multicast service. IGMP Query thereby identifies the ports containing hosts requesting to join the service and sends data out to those ports only. It then propagates the service request up to any neighboring multicast switch/router to ensure that it will continue to receive the multicast service.

The purpose of IP multicast filtering is to optimize a switched network's performance, so multicast packets will only be forwarded to those ports containing multicast group hosts or multicast routers/switches, instead of flooding traffic to all ports in the subnet (VLAN).

You can also configure a single network-wide multicast VLAN shared by hosts residing in other standard or private VLAN groups, preserving security and data isolation "Multicast VLAN Registration" on page 18-23.

18-2 Layer 2 IGMP (Snooping and Query)

IGMP Snooping and Query – If multicast routing is not supported on other switches in your network, you can use IGMP Snooping and IGMP Query ("Configuring IGMP Snooping and Query Parameters" on page 18-4) to monitor IGMP service requests passing between multicast clients and servers, and dynamically configure the switch ports which need to forward multicast traffic. IGMP Snooping conserves bandwidth on network segments where no node has expressed interest in receiving a specific multicast service. For switches that do not support multicast routing, or where multicast routing is already enabled on other switches in the local network segment, IGMP Snooping is the only service required to support multicast filtering.

When using IGMPv3 snooping, service requests from IGMP Version 1, 2 or 3 hosts are all forwarded to the upstream router as IGMPv3 reports. The primary enhancement provided by IGMPv3 snooping is in keeping track of information about the specific multicast sources which downstream IGMPv3 hosts have requested or refused[1]. The switch maintains information about multicast groups, where a group indicates a multicast flow for which the hosts have *not* requested a specific source (the only option for IGMPv1 and v2 hosts unless statically configured on the switch). For IGMPv1/v2/v3 hosts, the source address of a channel is always null (indicating that any source is acceptable).

1. Source IP lists is not supported in IGMPv3 reports by the switch due to an ASIC limitation.

NOTE: When the switch is configured to use IGMPv3 snooping, the snooping version may be downgraded to version 2 or version 1, depending on the version of the IGMP query packets detected on each VLAN.

NOTE: IGMP snooping will not function unless a multicast router port is enabled on the switch. This can accomplished in one of two ways. A static router port can be manually configured (see "Specifying Static Interfaces for a Multicast Router" on page 18-8). Using this method, the router port is never timed out, and will continue to function until explicitly removed. The other method relies on the switch to dynamically create multicast routing ports whenever multicast routing protocol packets or IGMP query packets are detected on a port.

NOTE: A maximum of up to 255 multicast entries can be maintained for IGMP snooping. Once the table is full, no new entries are learned. Any subsequent multicast traffic not found in the table is dropped if unregistered-flooding is disabled (default behavior) and no router port is configured in the attached VLAN, or flooded throughout the VLAN if unregistered-flooding is enabled (see "Configuring IGMP Snooping and Query Parameters" on page 18-4).

Static IGMP Router Interface – If IGMP snooping cannot locate the IGMP querier, you can manually designate a known IGMP querier (i.e., a multicast router/switch) connected over the network to an interface on your switch ("Specifying Static Interfaces for a Multicast Router" on page 18-8). This interface will then join all the current multicast groups supported by the attached router/switch to ensure that multicast traffic is passed to all appropriate interfaces within the switch.

Static IGMP Host Interface – For multicast applications that you need to control more carefully, you can manually assign a multicast service to specific interfaces on the switch ("Assigning Interfaces to Multicast Services" on page 18-10).

IGMP Snooping with Proxy Reporting – The switch supports last leave, and query suppression (as defined in DSL Forum TR-101, April 2006):

- When proxy reporting is disabled, all IGMP reports received by the switch are forwarded natively to the upstream multicast routers.
- Last Leave: Intercepts, absorbs and summarizes IGMP leaves coming from IGMP hosts. IGMP leaves are relayed upstream only when necessary, that is, when the last user leaves a multicast group.
- Query Suppression: Intercepts and processes IGMP queries in such a way that IGMP specific queries are never sent to client ports.

The only deviation from TR-101 is that the marking of IGMP traffic initiated by the switch with priority bits as defined in R-250 is not supported.

Configuring IGMP Snooping and Query Parameters

Use the MULTICAST > IGMP SNOOPING > GENERAL page to configure the switch to forward multicast traffic intelligently. Based on the IGMP query and report messages, the switch forwards multicast traffic only to the ports that request it. This prevents the switch from broadcasting the traffic to all ports and possibly disrupting network performance.

CLI References

See Section 38-1: "IGMP Snooping" on page 38-1 for CLI reference information.

Command Usage

- **IGMP Snooping** – This switch can passively snoop on IGMP Query and Report packets transferred between IP multicast routers/switches and IP multicast host groups to identify the IP multicast group members. It simply monitors the IGMP packets passing through it, picks out the group registration information, and configures the multicast filters accordingly.

NOTE: If unknown multicast traffic enters a VLAN which has been configured with a router port, the traffic is forwarded to that port. However, if no router port exists on the VLAN, the traffic is dropped if unregistered-flooding is disabled (default behavior), or flooded throughout the VLAN if unregistered-flooding is enabled (see "Unregistered Data Flood" in the Command Attributes section).

- **IGMP Querier** – A router, or multicast-enabled switch, can periodically ask their hosts if they want to receive multicast traffic. If there is more than one router/switch on the LAN performing IP multicasting, one of these devices is elected "querier" and assumes the role of querying the LAN for group members. It then propagates the service requests on to any upstream multicast switch/router to ensure that it will continue to receive the multicast service.

NOTE: Multicast routers use this information from IGMP snooping and query reports, along with a multicast routing protocol such as DVMRP or PIM, to support IP multicasting across the Internet.

Parameters

These parameters are displayed in the web interface:

- **IGMP Snooping Status** – When enabled, the switch will monitor network traffic to determine which hosts want to receive multicast traffic. This is referred to as IGMP Snooping. (Default: Disabled)

  When IGMP snooping is enabled globally, the per VLAN interface settings for IGMP snooping take precedence (see "Setting IGMP Snooping Status per Interface" on page 18-12).

When IGMP snooping is disabled globally, snooping can still be configured per VLAN interface, but the interface settings will not take effect until snooping is re-enabled globally.

- **Proxy Reporting Status** – Enables IGMP Snooping with Proxy Reporting. (Default: Disabled)

  When proxy reporting is enabled with this command, the switch performs “IGMP Snooping with Proxy Reporting” (as defined in DSL Forum TR-101, April 2006), including last leave, and query suppression.

  Last leave sends out a proxy query when the last member leaves a multicast group, and query suppression means that neither specific queries nor general queries are forwarded from an upstream multicast router to hosts downstream from this device.

  When proxy reporting is disabled, all IGMP reports received by the switch are forwarded natively to the upstream multicast routers.

- **TCN Flood** – Enables flooding of multicast traffic if a spanning tree topology change notification (TCN) occurs. (Default: Disabled)

  When a spanning tree topology change occurs, the multicast membership information learned by switch may be out of date. For example, a host linked to one port before the topology change (TC) may be moved to another port after the change. To ensure that multicast data is delivered to all receivers, by default, an switch in a VLAN (with IGMP snooping enabled) that receives a Bridge Protocol Data Unit (BPDU) with TC bit set (by the root bridge) will enter into “multicast flooding mode” for a period of time until the topology has stabilized and the new locations of all multicast receivers are learned.

  If a topology change notification (TCN) is received, and all the uplink ports are subsequently deleted, a time out mechanism is used to delete all of the currently learned multicast channels.

  When a new uplink port starts up, the switch sends unsolicited reports for all currently learned channels out the new uplink port.

  By default, the switch immediately enters into “multicast flooding mode” when a spanning tree topology change occurs. In this mode, multicast traffic will be flooded to all VLAN ports. If many ports have subscribed to different multicast groups, flooding may cause excessive packet loss on the link between the switch and the end host. Flooding may be disabled to avoid this, causing multicast traffic to be delivered only to those ports on which multicast group members have been learned. Otherwise, the time spent in flooding mode can be manually configured to reduce excessive loading.

  When the spanning tree topology changes, the root bridge sends a proxy query to quickly re-learn the host membership/port relations for multicast channels. The root bridge also sends an unsolicited Multicast Router Discover (MRD) request to quickly locate the multicast routers in this VLAN.

  The proxy query and unsolicited MRD request are flooded to all VLAN ports except for the receiving port when the switch receives such packets.

- **TCN Query Solicit** – Sends out an IGMP general query solicitation when a spanning tree topology change notification (TCN) occurs. (Default: Disabled)

  When the root bridge in a spanning tree receives a TCN for a VLAN where IGMP snooping is enabled, it issues a global IGMP leave message (or query solicitation). When a switch receives this solicitation, it floods it to all ports in the VLAN where the spanning tree change occurred. When an upstream multicast router receives this solicitation, it immediately issues an IGMP general query.

  A query solicitation can be sent whenever the switch notices a topology change, even if it is not the root bridge in spanning tree.

- **Router Alert Option** – Discards any IGMPv2/v3 packets that do not include the Router Alert option. (Default: Disabled)

  As described in Section 9.1 of RFC 3376 for IGMP Version 3, the Router Alert Option can be used to protect against DOS attacks. One common method of attack is launched by an intruder who takes over the role of querier, and starts overloading multicast hosts by sending a large number of queries, each with the Maximum Response Time set to a large value.

  To protect against this kind of attack, (1) routers should not forward queries. This is easier to accomplish if the query carries the Router Alert option. (2) Also, when the switch is acting in the role of a multicast host (such as when using proxy routing), it should ignore version 2 or 3 queries that do not contain the Router Alert option.

- **Unregistered Data Flooding** – Floods unregistered multicast traffic into the attached VLAN. (Default: Disabled)

  Once the table used to store multicast entries for IGMP snooping and multicast routing is filled, no new entries are learned. If no router port is configured in the attached VLAN, and unregistered-flooding is disabled, any subsequent multicast traffic not found in the table is dropped, otherwise it is flooded throughout the VLAN.

- **Version Exclusive** – Discards any received IGMP messages which use a version different to that currently configured by the IGMP Version attribute. (Default: Disabled)

- **IGMP Unsolicited Report Interval** – Specifies how often the upstream interface should transmit unsolicited IGMP reports when proxy reporting is enabled. (Range: 1-65535 seconds, Default: 400 seconds)

  When a new upstream interface (that is, uplink port) starts up, the switch sends unsolicited reports for all currently learned multicast channels via the new upstream interface.

  This command only applies when proxy reporting is enabled.

- **Router Port Expire Time** – The time the switch waits after the previous querier stops before it considers it to have expired. (Range: 1-65535, Recommended Range: 300-500 seconds, Default: 300)

- **IGMP Snooping Version** – Sets the protocol version for compatibility with other devices on the network. This is the IGMP Version the switch uses to send snooping reports. (Range: 1-3; Default: 2)

This attribute configures the IGMP report/query version used by IGMP snooping. Versions 1 - 3 are all supported, and versions 2 and 3 are backward compatible, so the switch can operate with other devices, regardless of the snooping version employed.

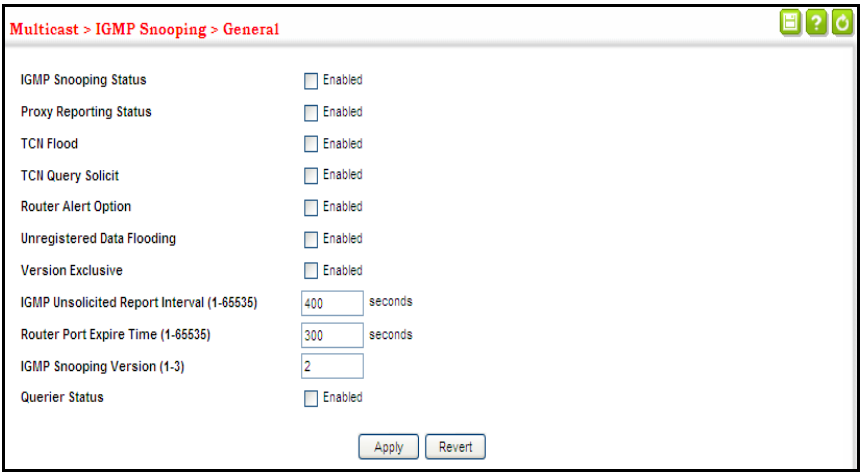
- **Querier Status** – When enabled, the switch can serve as the Querier, which is responsible for asking hosts if they want to receive multicast traffic. This feature is not supported for IGMPv3 snooping. (Default: Disabled)

Web Interface

To configure general settings for IGMP Snooping and Query:

1. Click MULTICAST > IGMP SNOOPING > GENERAL .
2. Adjust the IGMP SETTINGS as required.
3. Click APPLY.

Figure 18-2. Configuring General Settings for IGMP Snooping



Specifying Static Interfaces for a Multicast Router

Use the MULTICAST > IGMP SNOOPING > MULTICAST ROUTER (ADD) page to statically attach an interface to a multicast router/switch.

Depending on network connections, IGMP snooping may not always be able to locate the IGMP querier. Therefore, if the IGMP querier is a known multicast router/switch connected over the network to an interface (port or trunk) on the switch, the interface (and a specified VLAN) can be manually configured to join all the current multicast groups supported by the attached router. This can ensure that multicast traffic is passed to all the appropriate interfaces within the switch.

CLI References

See Section 38-2: "Static Multicast Routing" on page 38-25 for CLI reference information.

Command Usage

IGMP Snooping must be enabled globally on the switch (see "Configuring IGMP Snooping and Query Parameters" on page 18-4) before a multicast router port can take effect.

Parameters

These parameters are displayed in the web interface:

- **VLAN** – Selects the VLAN which is to propagate all multicast traffic coming from the attached multicast router. (Range: 1-4093)
- **Interface** – Activates the Port or Trunk scroll down list.
- **Port** or **Trunk** – Specifies the interface attached to a multicast router.

Web Interface

To specify a static interface attached to a multicast router:

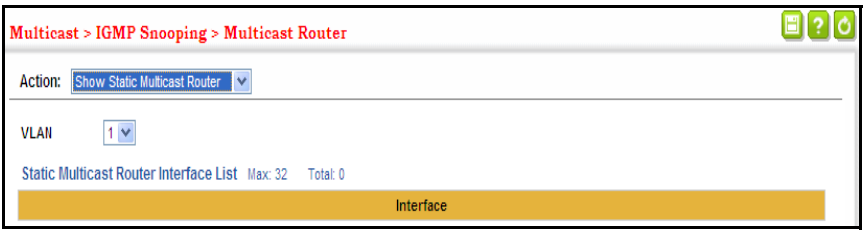
1. Click MULTICAST > IGMP SNOOPING > MULTICAST ROUTER.
2. Select ADD STATIC MULTICAST ROUTER from the ACTION list.
3. Select the VLAN which will forward all the corresponding multicast traffic, and select the port or trunk attached to the multicast router.
4. Click APPLY.

Figure 18-3. Configuring a Static Interface for a Multicast Router

To show the static interfaces attached to a multicast router:

1. Click MULTICAST > IGMP SNOOPING > MULTICAST ROUTER.
2. Select SHOW STATIC MULTICAST ROUTER from the ACTION list.
3. Select the VLAN for which to display this information.

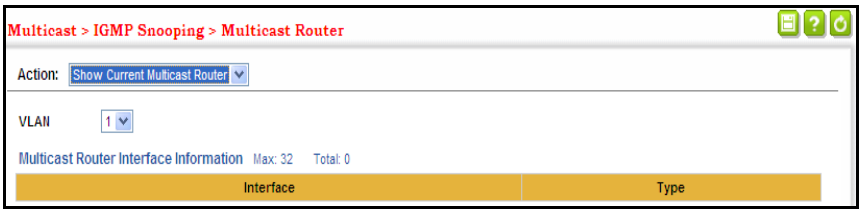
Figure 18-4. Showing Static Interfaces Attached a Multicast Router



To show the all interfaces attached to a multicast router:

1. Click MULTICAST > IGMP SNOOPING > MULTICAST ROUTER.
2. Select CURRENT MULTICAST ROUTER from the ACTION list.
3. Select the VLAN for which to display this information.

Figure 18-5. Showing Current Interfaces Attached a Multicast Router



Assigning Interfaces to Multicast Services

Use the MULTICAST > IGMP SNOOPING > IGMP MEMBER (ADD STATIC MEMBER) page to statically assign a multicast service to an interface.

Multicast filtering can be dynamically configured using IGMP Snooping and IGMP Query messages (see "Configuring IGMP Snooping and Query Parameters" on page 18-4). However, for certain applications that require tighter control, it may be necessary to statically configure a multicast service on the switch. First add all the ports attached to participating hosts to a common VLAN, and then assign the multicast service to that VLAN group.

CLI References

See "ip igmp snooping vlan static" on page 38-22 for CLI reference information.

Command Usage

- Static multicast addresses are never aged out.
- When a multicast address is assigned to an interface in a specific VLAN, the corresponding traffic can only be forwarded to ports within that VLAN.

Parameters

These parameters are displayed in the web interface:

- **VLAN** – Specifies the VLAN which is to propagate the multicast service. (Range: 1-4093)
- **Interface** – Activates the Port or Trunk scroll down list.
- **Port** or **Trunk** – Specifies the interface assigned to a multicast group.
- **Multicast IP** – The IP address for a specific multicast service.

Web Interface

To statically assign an interface to a multicast service:

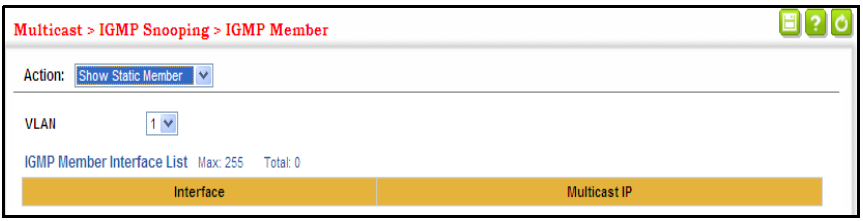
1. Click MULTICAST > IGMP SNOOPING > IGMP MEMBER.
2. Select ADD STATIC MEMBER from the ACTION list.
3. Select the VLAN that will propagate the multicast service, specify the interface attached to a multicast service (through an IGMP-enabled switch or multicast router), and enter the multicast IP address.
4. Click APPLY.

Figure 18-6. Assigning an Interface to a Multicast Service

To show the static interfaces assigned to a multicast service:

1. Click MULTICAST > IGMP SNOOPING > IGMP MEMBER.
2. Select SHOW STATIC MEMBER from the ACTION list.
3. Select the VLAN for which to display this information.

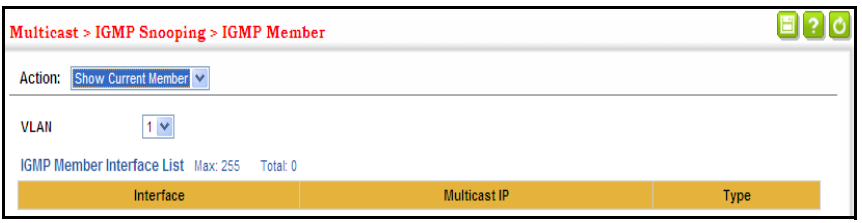
Figure 18-7. Showing Static Interfaces Assigned to a Multicast Service



To show the all interfaces statically or dynamically assigned to a multicast service:

1. Click MULTICAST > IGMP SNOOPING > IGMP MEMBER.
2. Select SHOW CURRENT MEMBER from the ACTION list.
3. Select the VLAN for which to display this information.

Figure 18-8. Showing Current Interfaces Assigned to a Multicast Service



Setting IGMP Snooping Status per Interface

Use the MULTICAST > IGMP SNOOPING > INTERFACE (CONFIGURE) page to configure IGMP snooping attributes for a VLAN interface. To configure snooping globally, refer to "Configuring IGMP Snooping and Query Parameters" on page 18-4.

CLI References

See Section 38-1: "IGMP Snooping" on page 38-1 for CLI reference information.

Command Usage

Multicast Router Discovery

There have been many mechanisms used in the past to identify multicast routers. This has lead to interoperability issues between multicast routers and snooping switches from different vendors. In response to this problem, the Multicast Router Discovery (MRD) protocol has been developed for use by IGMP snooping and multicast routing devices. MRD is used to discover which interfaces are attached to multicast routers, allowing IGMP-enabled devices to determine where to send multicast source and group membership messages. (MRD is specified in draft-ietf-magma-mrdisc-07.)

Multicast source data and group membership reports must be received by all multicast routers on a segment. Using the group membership protocol query messages to discover multicast routers is insufficient due to query suppression. MRD therefore provides a standardized way to identify multicast routers without relying on any particular multicast routing protocol.

NOTE: The default values recommended in the MRD draft are implemented in the switch.

Multicast Router Discovery uses the following three message types to discover multicast routers:

- Multicast Router Advertisement – Advertisements are sent by routers to advertise that IP multicast forwarding is enabled. These messages are sent unsolicited periodically on all router interfaces on which multicast forwarding is enabled. They are sent upon the occurrence of these events:
  - Upon the expiration of a periodic (randomized) timer.
  - As a part of a router's start up procedure.
  - During the restart of a multicast forwarding interface.
  - On receipt of a Solicitation message.

- Multicast Router Solicitation – Devices send Solicitation messages in order to solicit Advertisement messages from multicast routers. These messages are used to discover multicast routers on a directly attached link. Solicitation messages are also sent whenever a multicast forwarding interface is initialized or re-initialized. Upon receiving a solicitation on an interface with IP multicast forwarding and MRD enabled, a router will respond with an Advertisement.
- Multicast Router Termination – These messages are sent when a router stops IP multicast routing functions on an interface. Termination messages are sent by multicast routers when:
  - Multicast forwarding is disabled on an interface.
  - An interface is administratively disabled.
  - The router is gracefully shut down.

Advertisement and Termination messages are sent to the All-Snoopers multicast address. Solicitation messages are sent to the All-Routers multicast address.

NOTE: MRD messages are flooded to all ports in a VLAN where IGMP snooping or routing has been enabled. To ensure that older switches which do not support MRD can also learn the multicast router port, the switch floods IGMP general query packets, which do not have a null source address (0.0.0.0), to all ports in the attached VLAN. IGMP packets with a null source address are only flooded to all ports in the VLAN if the system is operating in multicast flooding mode, such as when a new VLAN or new router port is being established, or an spanning tree topology change has occurred. Otherwise, this kind of packet is only forwarded to known multicast routing ports.

Parameters

These parameters are displayed in the web interface:

- **VLAN** – ID of configured VLANs. (Range: 1-4093)
- **IGMP Snooping Status** – When enabled, the switch will monitor network traffic on the indicated VLAN interface to determine which hosts want to receive multicast traffic. This is referred to as IGMP Snooping. (Default: Disabled)

  When IGMP snooping is enabled globally (see "Configuring IGMP Snooping and Query Parameters" on page 18-4), the per VLAN interface settings for IGMP snooping take precedence.

  When IGMP snooping is disabled globally, snooping can still be configured per VLAN interface, but the interface settings will not take effect until snooping is re-enabled globally.
- **Version Exclusive** – Discards any received IGMP messages (except for multicast protocol packets) which use a version different to that currently configured by the IGMP Version attribute. (Default: Disabled)

If version exclusive is disabled on a VLAN, then this setting is based on the global setting configured on the Multicast > IGMP Snooping > General page. If it is enabled on a VLAN, then this setting takes precedence over the global setting.

- **Immediate Leave Status** – Immediately deletes a member port of a multicast service if a leave packet is received at that port and immediate leave is enabled for the parent VLAN. (Default: Disabled)

  If immediate leave is not used, a multicast router (or querier) will send a group-specific query message when an IGMPv2 group leave message is received. The router/querier stops forwarding traffic for that group only if no host replies to the query within the specified time out period. Note that this time out is set to Last Member Query Interval * Robustness Variable (fixed at 2) as defined in RFC 2236.

  If immediate leave is enabled, the switch assumes that only one host is connected to the interface. Therefore, immediate leave should only be enabled on an interface if it is connected to only one IGMP-enabled device, either a service host or a neighbor running IGMP snooping.

  This attribute is only effective if IGMP snooping is enabled, and IGMPv2 snooping is used.

- **Multicast Router Discovery** – MRD is used to discover which interfaces are attached to multicast routers. (Default: Enabled)

- **General Query Suppression** – Suppresses general queries except for ports attached to downstream multicast hosts. (Default: Disabled)

  By default, general query messages are flooded to all ports, except for the multicast router through which they are received.

  If general query suppression is enabled, then these messages are forwarded only to downstream ports which have joined a multicast service.

- **Proxy Reporting** – Enables IGMP Snooping with Proxy Reporting. (Default: Based on global setting)

  When proxy reporting is enabled with this command, the switch performs "IGMP Snooping with Proxy Reporting" (as defined in DSL Forum TR-101, April 2006), including last leave, and query suppression.

  Last leave sends out a proxy query when the last member leaves a multicast group, and query suppression means that neither specific queries nor general queries are forwarded from an upstream multicast router to hosts downstream from this device.

- **Interface Version** – Sets the protocol version for compatibility with other devices on the network. This is the IGMP Version the switch uses to send snooping reports. (Range: 1-3; Default: 2)

  This attribute configures the IGMP report/query version used by IGMP snooping. Versions 1 - 3 are all supported, and versions 2 and 3 are backward compatible, so the switch can operate with other devices, regardless of the snooping version employed.

- **Query Interval** – The interval between sending IGMP general queries. (Range: 2-31744 seconds; Default: 125 seconds)

  An IGMP general query message is sent by the switch at the interval specified by this attribute. When this message is received by downstream hosts, all receivers build an IGMP report for the multicast groups they have joined.

  This command applies when the switch is serving as the querier ("Configuring IGMP Snooping and Query Parameters" on page 18-4), or as a proxy host when IGMP snooping proxy reporting is enabled (page 18-4).

- **Query Response Interval** – The maximum time the system waits for a response to general queries. (Range: 10-31744 tenths of a second; Default: 10 seconds)

  This command applies when the switch is serving as the querier ("Configuring IGMP Snooping and Query Parameters" on page 18-4), or as a proxy host when IGMP snooping proxy reporting is enabled ("Configuring IGMP Snooping and Query Parameters" on page 18-4).

- **Last Member Query Interval** – The interval to wait for a response to a group-specific query message. (Range: 1-31744 tenths of a second in multiples of 10; Default: 1 second)

  When a multicast host leaves a group, it sends an IGMP leave message. When the leave message is received by the switch, it checks to see if this host is the last to leave the group by sending out an IGMP group-specific query message, and starts a timer. If no reports are received before the timer expires, the group record is deleted, and a report is sent to the upstream multicast router.

  A reduced value will result in reduced time to detect the loss of the last member of a group or source, but may generate more burst traffic.

  This attribute will take effect only if IGMP snooping proxy reporting is enabled (see "Configuring IGMP Snooping and Query Parameters" on page 18-4) or IGMP querier is enabled.

- **Last Member Query Count** – The number of IGMP proxy group-specific or query messages that are sent out before the system assumes there are no more local members. (Range: 1-255; Default: 2)

  This attribute will take effect only if IGMP snooping proxy reporting or IGMP querier is enabled.

- **Proxy Query Address** – A static source address for locally generated query and report messages used by IGMP Proxy Reporting. (Range: Any valid IP unicast address; Default: 0.0.0.0)

  IGMP Snooping uses a null IP address of 0.0.0.0 for the source of IGMP query messages which are proxied to downstream hosts to indicate that it is not the elected querier, but is only proxying these messages as defined in RFC 4541. The switch also uses a null address in IGMP reports sent to upstream ports.

  Many hosts do not implement RFC 4541, and therefore do not understand query messages with the source address of 0.0.0.0. These hosts will therefore not reply to the queries, causing the multicast router to stop sending traffic to them.

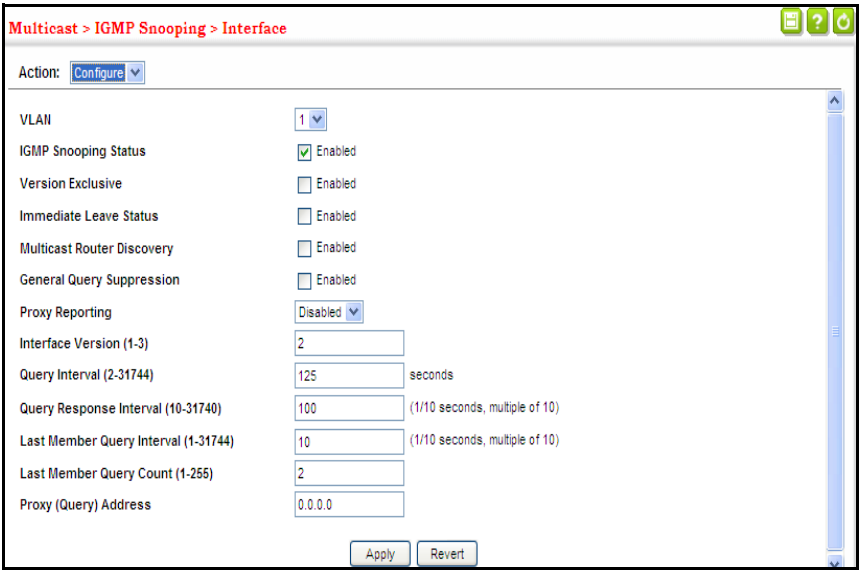
To resolve this problem, the source address in proxied IGMP query messages can be replaced with any valid unicast address (other than the router's own address).

Web Interface

To configure IGMP snooping on a VLAN:

1. Click MULTICAST > IGMP SNOOPING > INTERFACE.
2. Select CONFIGURE from the ACTION list.
3. Select the VLAN to configure and update the required parameters.
4. Click APPLY.

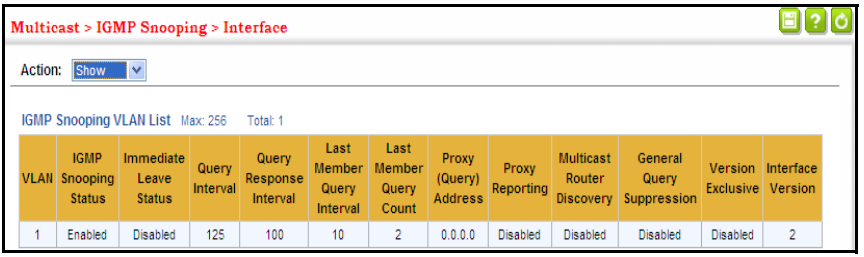
Figure 18-9. Configuring IGMP Snooping on an Interface


Multicast > IGMP Snooping > Interface
Action: Configure
VLAN 1
IGMP Snooping Status Enabled
Version Exclusive Enabled
Immediate Leave Status Enabled
Multicast Router Discovery Enabled
General Query Suppression Enabled
Proxy Reporting Disabled
Interface Version (1-3) 2
Query Interval (2-31744) 125 seconds
Query Response Interval (10-31740) 100 (1/10 seconds, multiple of 10)
Last Member Query Interval (1-31744) 10 (1/10 seconds, multiple of 10)
Last Member Query Count (1-255) 2
Proxy (Query) Address 0.0.0.0
Apply
Revert

To show the interface settings for IGMP snooping:

1. Click MULTICAST > IGMP SNOOPING > INTERFACE.
2. Select SHOW from the ACTION list.

Figure 18-10. Showing Interface Settings for IGMP Snooping



Displaying Multicast Groups Discovered by IGMP Snooping

Use the MULTICAST > IGMP SNOOPING > FORWARDING ENTRY page to display the forwarding entries learned through IGMP Snooping.

CLI References

See "show ip igmp snooping group" on page 38-24 for CLI reference information.

Command Usage

To display information about multicast groups, IGMP Snooping must first be enabled on the switch (see "Configuring IGMP Snooping and Query Parameters" on page 18-4).

Parameters

These parameters are displayed in the web interface:

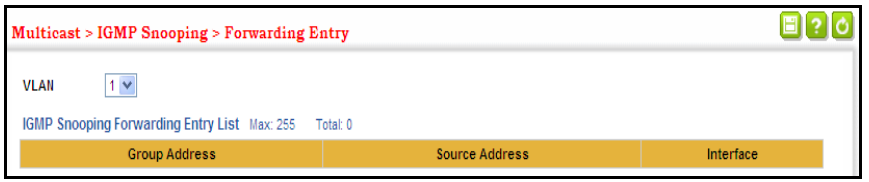
- **VLAN** – An interface on the switch that is forwarding traffic to downstream ports for the specified multicast group address.
- **Group Address** – IP multicast group address with subscribers directly attached or downstream from the switch, or a static multicast group assigned to this interface.
- **Source Address** – The address of one of the multicast servers transmitting traffic to the specified group.
- **Interface** – A downstream port or trunk that is receiving traffic for the specified multicast group. This field may include both dynamically and statically configured multicast router ports.

Web Interface

To show multicast groups learned through IGMP snooping:

1. Click MULTICAST > IGMP SNOOPING > FORWARDING ENTRY.
2. Select the VLAN for which to display this information.

Figure 18-11. Showing Multicast Groups Learned by IGMP Snooping



18-3 Filtering and Throttling IGMP Groups

In certain switch applications, the administrator may want to control the multicast services that are available to end users. For example, an IP/TV service based on a specific subscription plan. The IGMP filtering feature fulfills this requirement by restricting access to specified multicast services on a switch port, and IGMP throttling limits the number of simultaneous multicast groups a port can join.

IGMP filtering enables you to assign a profile to a switch port that specifies multicast groups that are permitted or denied on the port. An IGMP filter profile can contain one or more addresses, or a range of multicast addresses; but only one profile can be assigned to a port. When enabled, IGMP join reports received on the port are checked against the filter profile. If a requested multicast group is permitted, the IGMP join report is forwarded as normal. If a requested multicast group is denied, the IGMP join report is dropped.

IGMP throttling sets a maximum number of multicast groups that a port can join at the same time. When the maximum number of groups is reached on a port, the switch can take one of two actions; either "deny" or "replace." If the action is set to deny, any new IGMP join reports will be dropped. If the action is set to replace, the switch randomly removes an existing group and replaces it with the new multicast group.

Enabling IGMP Filtering and Throttling

Use the MULTICAST > IGMP SNOOPING > FILTER (CONFIGURE GENERAL) page to enable IGMP filtering and throttling globally on the switch.

CLI References

See "ip igmp filter (Global Configuration)" on page 38-28 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **IGMP Filter Status** – Enables IGMP filtering and throttling globally for the switch. (Default: Disabled)

Web Interface

To enable IGMP filtering and throttling on the switch:

1. Click MULTICAST > IGMP SNOOPING > FILTER.
2. Select CONFIGURE GENERAL from the STEP list.
3. Enable IGMP FILTER STATUS.
4. Click APPLY.

Figure 18-12. Enabling IGMP Filtering and Throttling

Configuring IGMP Filter Profiles

Use the MULTICAST > IGMP SNOOPING > FILTER (ADD) page to create an IGMP profile and set its access mode. Then use the (ADD MULTICAST GROUP RANGE) page to configure the multicast groups to filter.

CLI References

See Section 38-3: "IGMP Filtering and Throttling" on page 38-27 for CLI reference information.

Command Usage

Specify a range of multicast groups by entering a start and end IP address; or specify a single multicast group by entering the same IP address for the start and end of the range.

Parameters

These parameters are displayed in the web interface:

Add

- **Profile ID** – Creates an IGMP profile. (Range: 1-4294967295)
- **Access Mode** – Sets the access mode of the profile; either permit or deny. (Default: Deny)

When the access mode is set to permit, IGMP join reports are processed when a multicast group falls within the controlled range. When the access mode is set to deny, IGMP join reports are only processed when the multicast group is not in the controlled range.

Add Multicast Group Range

- **Profile ID** – Selects an IGMP profile to configure.
- **Start Multicast IP Address** – Specifies the starting address of a range of multicast groups.
- **End Multicast IP Address** – Specifies the ending address of a range of multicast groups.

Web Interface

To create an IGMP filter profile and set its access mode:

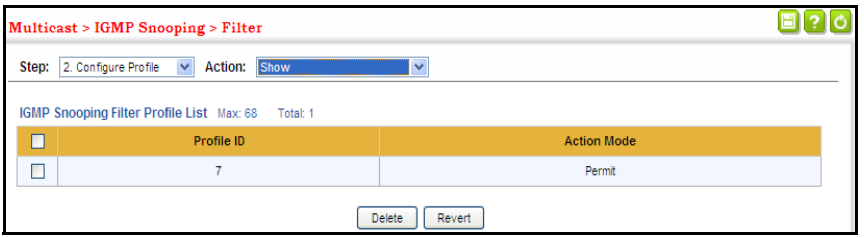
1. Click MULTICAST > IGMP SNOOPING > FILTER.
2. Select CONFIGURE PROFILE from the STEP list.
3. Select ADD from the ACTION list.
4. Enter the number for a profile, and set its access mode.
5. Click APPLY.

Figure 18-13. Creating an IGMP Filtering Profile

To show the IGMP filter profiles:

1. Click MULTICAST > IGMP SNOOPING > FILTER.
2. Select CONFIGURE PROFILE from the STEP list.
3. Select SHOW from the ACTION list.

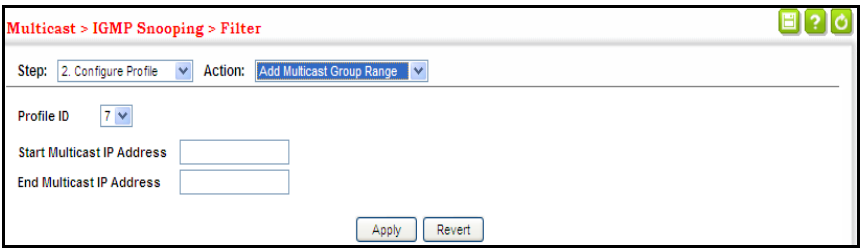
Figure 18-14. Showing the IGMP Filtering Profiles Created



To add a range of multicast groups to an IGMP filter profile:

1. Click MULTICAST > IGMP SNOOPING > FILTER.
2. Select CONFIGURE PROFILE from the STEP list.
3. Select ADD MULTICAST GROUP RANGE from the ACTION list.
4. Select the profile to configure, and add a multicast group address or range of addresses.
5. Click APPLY.

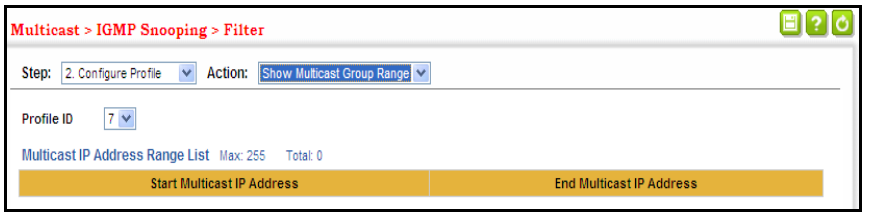
Figure 18-15. Adding Multicast Groups to an IGMP Filtering Profile



To show the multicast groups configured for an IGMP filter profile:

1. Click MULTICAST > IGMP SNOOPING > FILTER.
2. Select CONFIGURE PROFILE from the STEP list.
3. Select SHOW MULTICAST GROUP RANGE from the ACTION list.
4. Select the profile for which to display this information.

Figure 18-16. Showing the Groups Assigned to an IGMP Filtering Profile


Multicast > IGMP Snooping > Filter
Step: 2. Configure Profile
Action: Show Multicast Group Range
Profile ID 7
Multicast IP Address Range List Max: 255 Total: 0
Start Multicast IP Address
End Multicast IP Address

Configuring IGMP Filtering and Throttling for Interfaces

Use the MULTICAST > IGMP SNOOPING > FILTER (CONFIGURE INTERFACE) page to assign and IGMP filter profile to interfaces on the switch, or to throttle multicast traffic by limiting the maximum number of multicast groups an interface can join at the same time.

CLI References

See Section 38-3: "IGMP Filtering and Throttling" on page 38-27 for CLI reference information.

Command Usage

IGMP throttling sets a maximum number of multicast groups that a port can join at the same time. When the maximum number of groups is reached on a port, the switch can take one of two actions; either "deny" or "replace." If the action is set to deny, any new IGMP join reports will be dropped. If the action is set to replace, the switch randomly removes an existing group and replaces it with the new multicast group.

Parameters

These parameters are displayed in the web interface:

- **Interface** – Port or trunk identifier.

  An IGMP profile or throttling setting can be applied to a port or trunk. When ports are configured as trunk members, the trunk uses the settings applied to the first port member in the trunk.

- **Profile ID** – Selects an existing profile to assign to an interface.
- **Max Multicast Groups** – Sets the maximum number of multicast groups an interface can join at the same time. (Range: 0-255; Default: 255)
- **Current Multicast Groups** – Displays the current multicast groups the interface has joined.
- **Throttling Action Mode** – Sets the action to take when the maximum number of multicast groups for the interface has been exceeded. (Default: Deny)

- **Deny** - The new multicast group join report is dropped.
- **Replace** - The new multicast group replaces an existing group.

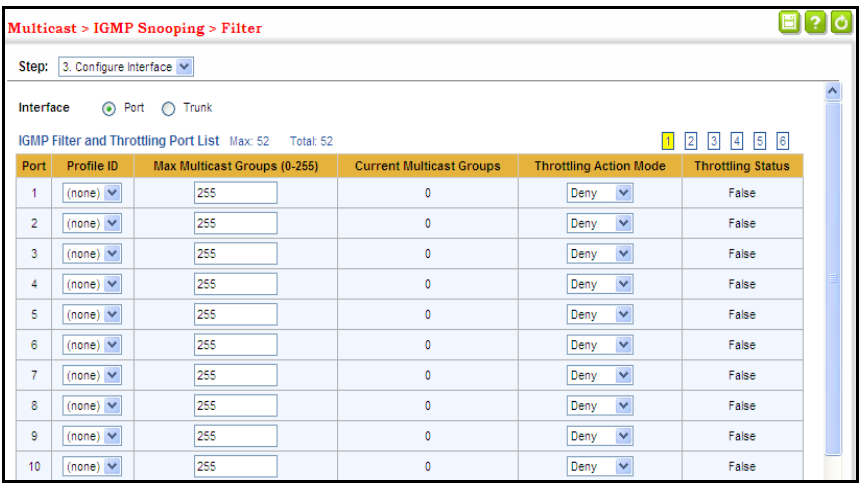
- **Throttling Status** – Indicates if the throttling action has been implemented on the interface. (Options: True or False)

Web Interface

To configure IGMP filtering or throttling for a port or trunk:

1. Click MULTICAST > IGMP SNOOPING > FILTER.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Select a profile to assign to an interface, then set the maximum number of allowed multicast groups and the throttling response.
4. Click APPLY.

Figure 18-17. Configuring IGMP Filtering and Throttling Interface Settings

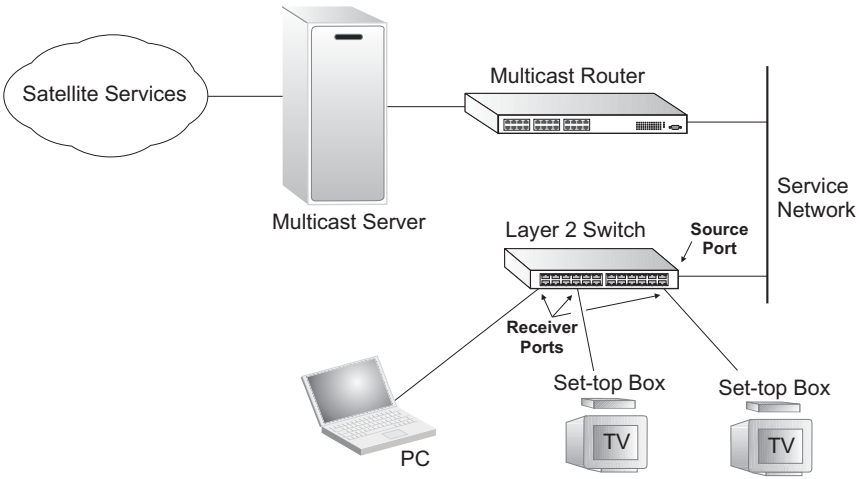

Multicast > IGMP Snooping > Filter
Step: 3. Configure Interface
Interface Port Trunk
IGMP Filter and Throttling Port List Max: 52 Total: 52
1 2 3 4 5 6
Port | Profile ID | Max Multicast Groups (0-255) | Current Multicast Groups | Throttling Action Mode | Throttling Status
1 | (none) | 255 | 0 | Deny | False
2 | (none) | 255 | 0 | Deny | False
3 | (none) | 255 | 0 | Deny | False
4 | (none) | 255 | 0 | Deny | False
5 | (none) | 255 | 0 | Deny | False
6 | (none) | 255 | 0 | Deny | False
7 | (none) | 255 | 0 | Deny | False
8 | (none) | 255 | 0 | Deny | False
9 | (none) | 255 | 0 | Deny | False
10 | (none) | 255 | 0 | Deny | False

18-4 Multicast VLAN Registration

Multicast VLAN Registration (MVR) is a protocol that controls access to a single network-wide VLAN most commonly used for transmitting multicast traffic (such as television channels or video-on-demand) across a service provider's network. Any multicast traffic entering an MVR VLAN is sent to all attached subscribers. This protocol can significantly reduce to processing overhead required to dynamically monitor and establish the distribution tree for a normal multicast VLAN. This makes it possible to support common multicast services over a wide part of the network without having to use any multicast routing protocol.

MVR maintains the user isolation and data security provided by VLAN segregation by passing only multicast traffic into other VLANs to which the subscribers belong. Even though common multicast streams are passed onto different VLAN groups from the MVR VLAN, users in different IEEE 802.1Q or private VLANs cannot exchange any information (except through upper-level routing services).

Figure 18-18. MVR Concept



Command Usage

- General Configuration Guidelines for MVR:

1. Enable MVR globally on the switch, select the MVR VLAN, and add the multicast groups that will stream traffic to attached hosts (see "Configuring Global MVR Settings" on page 18-25).
2. Set the interfaces that will join the MVR as source ports or receiver ports (see "Configuring MVR Interface Status" on page 18-26).
3. For multicast streams that will run for a long term and be associated with a stable set of hosts, you can statically bind the multicast group to the participating interfaces (see "Assigning Static Multicast Groups to Interfaces" on page 18-28).

- Although MVR operates on the underlying mechanism of IGMP snooping, the two features operate independently of each other. One can be enabled or disabled without affecting the behavior of the other. However, if IGMP snooping and MVR are both enabled, MVR reacts only to join and leave messages from multicast groups configured under MVR. Join and leave messages from all other multicast groups are managed by IGMP snooping. Also, note that only IGMP version 2 or 3 hosts can issue multicast join or leave messages. If MVR must be configured for an IGMP version 1 host, the multicast groups must be statically assigned (see "Assigning Static Multicast Groups to Interfaces" on page 18-28).

Configuring Global MVR Settings

Use the MULTICAST > MVR (Configure General) page to enable MVR globally on the switch, select the VLAN that will serve as the sole channel for common multicast streams supported by the service provider, and assign the multicast group address for each of these services to the MVR VLAN.

CLI References

See Section 38-4: "Multicast VLAN Registration" on page 38-35 for CLI reference information.

Command Usage

IGMP snooping and MVR share a maximum number of 256 groups. Any multicast streams received in excess of this limitation will be flooded to all ports in the associated VLAN.

Parameters

These parameters are displayed in the web interface:

- **MVR Status** – When MVR is enabled on the switch, any multicast data associated with an MVR group is sent from all designated source ports, to all receiver ports that have registered to receive data from that multicast group. (Default: Disabled)
- **MVR VLAN** – Identifier of the VLAN that serves as the channel for streaming multicast services using MVR. MVR source ports should be configured as members of the MVR VLAN (see "Adding Static Members to VLANs" on page 7-6), but MVR receiver ports should not be manually configured as members of this VLAN. (Default: 1)
- **MVR Running Status** – Indicates whether or not all necessary conditions in the MVR environment are satisfied. Running status is Active as long as MVR is enabled, the specified MVR VLAN exists, and a source port with a valid link has been configured (see "Configuring MVR Interface Status" on page 18-26).
- **MVR Group IP** – IP address for an MVR multicast group. (Range: 224.0.1.0 - 239.255.255.255; Default: no groups are assigned to the MVR VLAN)

  Any multicast data sent to this address is sent to all source ports on the switch and all receiver ports that have elected to receive data on that multicast address.

  The IP address range of 224.0.0.0 to 239.255.255.255 is used for multicast streams. MVR group addresses cannot fall within the reserved IP multicast address range of 224.0.0.x.
- **Count** – The number of contiguous MVR group addresses. (Range: 1-255; Default: 0)

Web Interface

To configure global settings for MVR:

1. Click MULTICAST > MVR.
2. Select CONFIGURE GENERAL from the STEP list.
3. Enable MVR GLOBALLY on the switch, select the MVR VLAN, and add the multicast groups that will stream traffic to participating hosts.
4. Click APPLY.

Figure 18-19. Configuring Global Settings for MVR

Configuring MVR Interface Status

Use the MULTICAST > MVR (CONFIGURE INTERFACE) page to configure each interface that participates in the MVR protocol as a source port or receiver port. If you are sure that only one subscriber attached to an interface is receiving multicast services, you can enable the immediate leave function.

CLI References

See fSection 38-4: "Multicast VLAN Registration" on page 38-35 or CLI reference information.

Command Usage

- A port configured as an MVR receiver or source port can join or leave multicast groups configured under MVR. However, note that these ports can also use IGMP snooping to join or leave any other multicast groups using the standard rules for multicast filtering.
- Receiver ports can belong to different VLANs, but should not normally be configured as a member of the MVR VLAN. MVR allows a receiver port to dynamically join or leave multicast groups sourced through the MVR VLAN. Multicast groups can also be statically assigned to a receiver port (see "Assigning Static Multicast Groups to Interfaces" on page 18-28).

Receiver ports should not be configured as a member of the MVR VLAN. Also, note that VLAN membership for MVR receiver ports cannot be set to access mode (see "Adding Static Members to VLANs" on page 7-6).

- One or more interfaces may be configured as MVR source ports. A source port is able to both receive and send data for configured MVR groups or for groups which have been statically assigned (see "Assigning Static Multicast Groups to Interfaces" on page 18-28).

  All source ports must belong to the MVR VLAN.

  Subscribers should not be directly connected to source ports.

- Immediate leave applies only to receiver ports. When enabled, the receiver port is immediately removed from the multicast group identified in the leave message. When immediate leave is disabled, the switch follows the standard rules by sending a query message to the receiver port and waiting for a response to determine if there are any remaining subscribers for that multicast group before removing the port from the group list.

  - Using immediate leave can speed up leave latency, but should only be enabled on a port attached to one multicast subscriber to avoid disrupting services to other group members attached to the same interface.
  - Immediate leave does not apply to multicast groups which have been statically assigned to a port.

Parameters

These parameters are displayed in the web interface:

- **Port** – Port identifier.
- **Type** – The following interface types are supported:
  - **Source** – An uplink port that can send and receive multicast data for the groups assigned to the MVR VLAN. Note that the source port must be manually configured as a member of the MVR VLAN (see "Adding Static Members to VLANs" on page 7-6).
  - **Receiver** – A subscriber port that can receive multicast data sent through the MVR VLAN. Any port configured as a receiver port will be dynamically added to the MVR VLAN when it forwards an IGMP report or join message from an attached host requesting any of the designated multicast services supported by the MVR VLAN. Just remember that only IGMP version 2 or 3 hosts can issue multicast join or leave messages. If MVR must be configured for an IGMP version 1 host, the multicast groups must be statically assigned (see "Assigning Static Multicast Groups to Interfaces" on page 18-28).
  - **Non-MVR** – An interface that does not participate in the MVR VLAN. (This is the default type.)
- **Oper. Status** – Shows the link status.

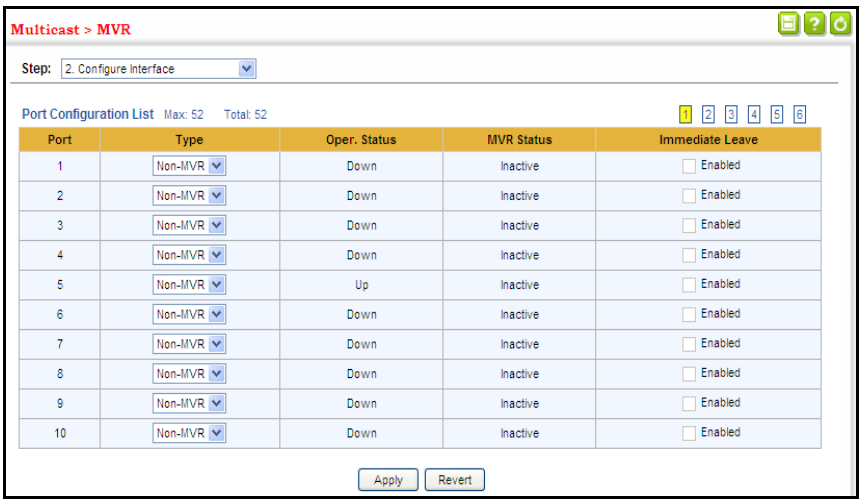
- **MVR Status** – Shows the MVR status. MVR status for source ports is "Active" if MVR is globally enabled on the switch. MVR status for receiver ports is "Active" only if there are subscribers receiving multicast traffic from one of the MVR groups, or a multicast group has been statically assigned to an interface.
- **Immediate Leave** – Configures the switch to immediately remove an interface from a multicast stream as soon as it receives a leave message for that group. (This option only applies to an interface configured as an MVR receiver.)

Web Interface

To configure interface settings for MVR:

1. Click MULTICAST > MVR.
2. Select CONFIGURE INTERFACE from the STEP list.
3. Set each port that will participate in the MVR protocol as a source port or receiver port, and optionally enable IMMEDIATE LEAVE on any receiver port to which only one subscriber is attached.
4. Click APPLY.

Figure 18-20. Configuring Interface Settings for MVR



Assigning Static Multicast Groups to Interfaces

Use the MULTICAST > MVR (CONFIGURE STATIC GROUP MEMBER) page to statically bind multicast groups to a port which will receive long-term multicast streams associated with a stable set of hosts.

CLI References

See "mvr vlan group" on page 38-39 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

- **Port** – Port identifier.
- **VLAN** – VLAN identifier
- **Group IP Address** – Defines a multicast service sent to the selected port. Multicast groups must be assigned from the MVR group range configured on the CONFIGURE GENERAL page.

Web Interface

To assign a static MVR group to a port:

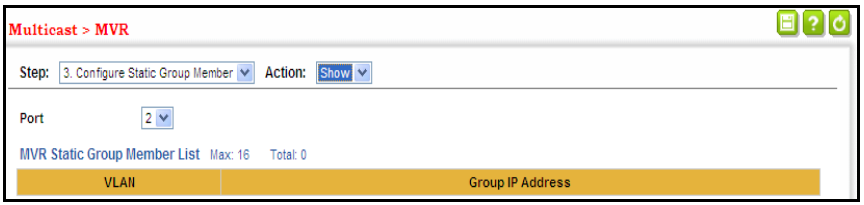
1. Click MULTICAST > MVR.
2. Select CONFIGURE STATIC GROUP MEMBER from the STEP list.
3. Select ADD from the ACTION list.
4. Select a VLAN and port member to receive the multicast stream, and then enter the multicast group address.
5. Click APPLY.

Figure 18-21. Assigning Static MVR Groups to a Port

To show the static MVR groups assigned to a port:

1. Click MULTICAST > MVR.
2. Select CONFIGURE STATIC GROUP MEMBER from the **STEP** list.
3. Select SHOW from the ACTION list.
4. Select the port for which to display this information.

Figure 18-22. Showing the Static MVR Groups Assigned to a Port



Showing Multicast Group Members

Use the MULTICAST > MVR (SHOW MEMBER) page to show the interfaces associated with multicast groups assigned to the MVR VLAN.

CLI References

See "show mvr" on page 38-40 for CLI reference information.

Parameters

These parameters are displayed in the web interface:

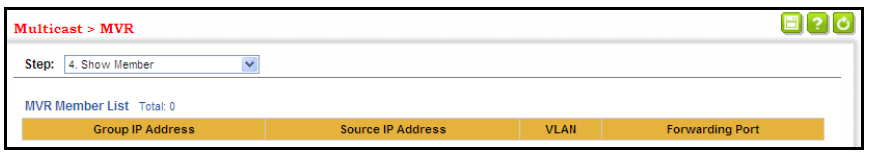
- **Group IP Address** – Multicast groups assigned to the MVR VLAN.
- **Source IP Address** – Indicates the source address of the multicast service, or displays an asterisk if the group address has been statically assigned.
- **VLAN** – Indicates the MVR VLAN receiving the multicast service.
- **Forwarding Port** – Shows the interfaces with subscribers for multicast services provided through the MVR VLAN. Also shows the VLAN through which the service is received. Note that this may be different from the MVR VLAN if the group address has been statically assigned.

Web Interface

To show the interfaces associated with multicast groups assigned to the MVR VLAN:

1. Click MULTICAST > MVR.
2. Select SHOW MEMBER from the STEP list.

Figure 18-23. Showing MVR Group Members



Chapter 19
Using the Command Line Interface

This chapter describes how to use the Command Line Interface (CLI).

19-1 Accessing the CLI

When accessing the management interface for the switch over a direct connection to the server's console port, or via a Telnet or Secure Shell connection (SSH), the switch can be managed by entering command keywords and parameters at the prompt. Using the switch's command-line interface (CLI) is very similar to entering commands on a UNIX system.

Console Connection

To access the switch through the console port, perform these steps:

1. At the console prompt, enter the user name and password. (The default user names are "ADMIN" and "guest" with corresponding passwords of "ADMIN" and "guest.") When the administrator user name and password is entered, the CLI displays the "SSE-G2252#" prompt and enters privileged access mode (i.e., Privileged Exec). But when the guest user name and password is entered, the CLI displays the "SSE-G2252>" prompt and enters normal access mode (i.e., Normal Exec).

NOTE: The displayed command prompt is based on the switch model (SSE-G2252 or SSE-G2252P).

2. Enter the necessary commands to complete your desired tasks.
3. When finished, exit the session with the "quit" or "exit" command.

After connecting to the system through the console port, the login screen displays:

```
User Access Verification
Username: ADMIN
Password:
  CLI session with the SSE-G2252 is opened.
  To end the CLI session, enter [Exit].
SSE-G2252#
```

Telnet Connection

Telnet operates over the IP transport protocol. In this environment, your management station and any network device you want to manage over the network must have a valid IP address. Valid IP addresses consist of four numbers, 0 to 255, separated by periods. Each address consists of a network portion and host portion. For example, the IP address assigned to this switch, 10.1.0.1, consists of a network portion (10.1.0) and a host portion (1).

NOTE: The IP address for this switch is obtained via DHCP by default.

To access the switch through a Telnet session, you must first set the IP address for the Master unit, and set the default gateway if you are managing the switch from a different IP subnet. For example,

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ip address 10.1.0.254 255.255.255.0
SSE-G2252(config-if)#exit
SSE-G2252(config)#ip default-gateway 10.1.0.254
SSE-G2252(config)#
```

If your corporate network is connected to another network outside your office or to the Internet, you need to apply for a registered IP address. However, if you are attached to an isolated network, then you can use any IP address that matches the network segment to which you are attached.

After you configure the switch with an IP address, you can open a Telnet session by performing these steps:

1. From the remote host, enter the Telnet command and the IP address of the device you want to access.
2. At the prompt, enter the user name and system password. The CLI will display the "Vty-*n*#" prompt for the administrator to show that you are using privileged access mode (i.e., Privileged Exec), or "Vty-*n*>" for the guest to show that you are using normal access mode (i.e., Normal Exec), where *n* indicates the number of the current Telnet session.
3. Enter the necessary commands to complete your desired tasks.
4. When finished, exit the session with the "quit" or "exit" command.

After entering the Telnet command, the login screen displays:

```
Username: ADMIN
Password:

  CLI session with the SSE-G2252 is opened.
  To end the CLI session, enter [Exit].

Vty-0#
```

NOTE: You can open up to four sessions to the device via Telnet.

19-2 Entering Commands

This section describes how to enter CLI commands.

Keywords and Arguments

A CLI command is a series of keywords and arguments. Keywords identify a command, and arguments specify configuration parameters. For example, in the command “show interfaces status ethernet 1/5,” **show interfaces** and **status** are keywords, **ethernet** is an argument that specifies the interface type, and **1/5** specifies the unit/port.

You can enter commands as follows:

- To enter a simple command, enter the command keyword.
- To enter multiple commands, enter each command in the required order. For example, to enable Privileged Exec command mode, and display the startup configuration, enter:

  ```
  SSE-G2252>enable
  SSE-G2252#show startup-config
  ```
- To enter commands that require parameters, enter the required parameters after the command keyword. For example, to set a password for the administrator, enter:

  ```
  SSE-G2252(config)#username admin password 0 smith
  ```

Minimum Abbreviation

The CLI will accept a minimum number of characters that uniquely identify a command. For example, the command “configure” can be entered as **con**. If an entry is ambiguous, the system will prompt for further input.

Command Completion

If you terminate input with a Tab key, the CLI will print the remaining characters of a partial keyword up to the point of ambiguity. In the “logging history” example, typing **log** followed by a tab will result in printing the command up to “**logging**.”

Getting Help on Commands

You can display a brief description of the help system by entering the help command. You can also display command syntax by using the “?” character to list keywords or parameters.

Showing Commands

If you enter a "?" at the command prompt, the system will display the first level of keywords or command groups. You can also display a list of valid keywords for a specific command. For example, the command "**system ?**" displays a list of possible system commands:

```
SSE-G2252#show ?
  access-group          Access groups
  access-list           Access lists
  accounting            Uses an accounting list with this name
  arp                   Information of ARP cache
  authorization         Enables EXEC accounting
  auto-traffic-control  Auto traffic control information
  bridge-ext            Bridge extension information
  cable-diagnostics     Shows the information of cable diagnostics
  calendar              Date and time information
  class-map             Displays class maps
  cluster               Display cluster
  dns                   DNS information
  dot1q-tunnel          dot1q-tunnel
  dot1x                 802.1X content
  garp                  GARP properties
  gvrp                  GVRP interface information
  history               Shows history information
  hosts                 Host information
  interfaces            Shows interface information
  ip                    IP information
  ipv6                  IPv6 information
  lacp                  LACP statistics
  line                  TTY line information
  lldp                  LLDP
  log                   Log records
  logging               Logging setting
  loop                  Shows the information of loopback
  mac                   MAC access list
  mac-address-table     Configuration of the address table
  mac-vlan              MAC-based VLAN information
  management            Shows management information
  memory                Memory utilization
  mvr                   multicast vlan registration
  network-access        Shows the entries of the secure port.
  nlm                   Show notification log
  policy-map            Displays policy maps
  port                  Port characteristics
  power                 Shows power
  power-save            Shows the power saving information
  protocol-vlan         Protocol-VLAN information
  public-key            Public key information
  qos                   Quality of Service
  queue                 Priority queue information
  radius-server         RADIUS server information
  reload                Shows the reload settings
  rmon                  Remote Monitoring Protocol
  rspan                 Display status of the current RSPAN configuration
  running-config        Information on the running configuration
  snmp                  Simple Network Management Protocol configuration
and statistics
  sntp                  Simple Network Time Protocol configuration
  spanning-tree         Spanning-tree configuration
```

```
  ssh                   Secure shell server connections
  startup-config        Startup system configuration
  subnet-vlan           IP subnet-based VLAN information
  system                System information
  tacacs-server         TACACS server information
  tech-support          Technical information
  time-range            Time range
  traffic-segmentation  Traffic segmentation information
  upgrade               Shows upgrade information
  users                 Information about users logged in
  version               System hardware and software versions
  vlan                  Shows virtual LAN settings
  voice                 Shows the voice VLAN information
  web-auth              Shows web authentication configuration
SSE-G2252#show
```

The command "**show interfaces ?**" will display the following information:

```
SSE-G2252#show interfaces ?
  counters       Interface counters information
  protocol-vlan  Protocol-VLAN information
  status         Shows interface status
  switchport     Shows interface switchport information
SSE-G2252#
```

Partial Keyword Lookup

If you terminate a partial keyword with a question mark, alternatives that match the initial letters are provided. (Remember not to leave a space between the command and question mark.) For example "**s?**" shows all the keywords starting with "s."

```
SSE-G2252#show s?
snmp            sntp            spanning-tree   ssh
startup-config
subnet-vlan     system
SSE-G2252#show s
```

Negating the Effect of Commands

For many configuration commands you can enter the prefix keyword "**no**" to cancel the effect of a command or reset the configuration to the default value. For example, the **logging** command will log system messages to a host server. To disable logging, specify the **no logging** command. This guide describes the negation effect for all applicable commands.

Using Command History

The CLI maintains a history of commands that have been entered. You can scroll back through the history of commands by pressing the up arrow key. Any command displayed in the history list can be executed again, or first modified and then executed.

Using the **show history** command displays a longer list of recently executed commands.

Understanding Command Modes

The command set is divided into Exec and Configuration classes. Exec commands generally display information on system status or clear statistical counters. Configuration commands, on the other hand, modify interface parameters or enable certain switching functions. These classes are further divided into different modes. Available commands depend on the selected mode. You can always enter a question mark "**?**" at the prompt to display a list of the commands available for the current mode. The command classes and associated modes are displayed in the following table:

Table 19-1. General Command Modes

Class	Mode	
Exec	Normal Privileged	
Configuration	Global[a]	Access Control List Class Map IGMP Profile Interface Line Multiple Spanning Tree Policy Map Time Range VLAN Database

a. You must be in Privileged Exec mode to access the Global configuration mode. You must be in Global Configuration mode to access any of the other configuration modes.

Exec Commands

When you open a new console session on the switch with the user name and password “guest,” the system enters the Normal Exec command mode (or guest mode), displaying the “SSE-G2252>” command prompt. Only a limited number of the commands are available in this mode. You can access all commands only from the Privileged Exec command mode (or administrator mode). To access Privilege Exec mode, open a new console session with the user name and password “ADMIN.” The system will now display the “SSE-G2252#” command prompt. You can also enter Privileged Exec mode from within Normal Exec mode, by entering the enable command, followed by the privileged level password “super.”

To enter Privileged Exec mode, enter the following user names and passwords:

```
Username: ADMIN
Password: [admin login password]

  CLI session with the SSE-G2252 is opened.
  To end the CLI session, enter [Exit].

SSE-G2252#
Username: guest
Password: [guest login password]

  CLI session with the SSE-G2252 is opened.
  To end the CLI session, enter [Exit].

SSE-G2252>enable
Password: [privileged level password]
SSE-G2252#
```

Configuration Commands

Configuration commands are privileged level commands used to modify switch settings. These commands modify the running configuration only and are not saved when the switch is rebooted. To store the running configuration in non-volatile storage, use the **copy running-config startup-config** command.

The configuration commands are organized into different modes:

- Global Configuration - These commands modify the system level configuration, and include commands such as **hostname** and **snmp-server community**.
- Access Control List Configuration - These commands are used for packet filtering.
- Class Map Configuration - Creates a DiffServ class map for a specified traffic type.
- IGMP Profile - Sets a profile group and enters IGMP filter profile configuration mode.
- Interface Configuration - These commands modify the port configuration such as **speed-duplex** and **negotiation**.
- Line Configuration - These commands modify the console port and Telnet configuration, and include command such as **parity** and **databits**.
- Policy Map Configuration - Creates a DiffServ policy map for multiple interfaces.
- Time Range - Sets a time range for use by other functions, such as Access Control Lists.
- VLAN Configuration - Includes the command to create VLAN groups.

To enter the Global Configuration mode, enter the command **configure** in Privileged Exec mode. The system prompt will change to "SSE-G2252(config)#" which gives you access privilege to all Global Configuration commands.

```
SSE-G2252#configure
SSE-G2252(config)#
```

To enter the other modes, at the configuration prompt type one of the following commands. Use the **exit** or **end** command to return to the Privileged Exec mode.

Table 19-2. Configuration Command Modes

Mode	Command	Prompt	Page
Line	line {console | vty}	SSE-G2252(config-line)	page 21-24
Access Control List	access-list ip access-list ipv6 access-list mac	SSE-G2252(config-std-acl) SSE-G2252(config-std-ipv6-acl) SSE-G2252(config-mac-acl)	page 26-2 page 26-11 page 26-18
Class Map	class-map	SSE-G2252(config-cmap)	page 37-2
Interface	interface {ethernet *port* | port-channel *id*| vlan *id*}	SSE-G2252(config-if)	page 27-2
Policy Map	policy-map	SSE-G2252(config-pmap)	page 37-6

Table 19-2. Configuration Command Modes (Continued)

Mode	Command	Prompt	Page
Time Range	time-range	SSE-G2252(config-time-range)	page 21-60
VLAN	vlan database	SSE-G2252(config-vlan)	page 35-9

For example, you can use the following commands to enter interface configuration mode, and then return to Privileged Exec mode

```
SSE-G2252(config)#interface ethernet 1/5
.
.
.
SSE-G2252(config-if)#exit
SSE-G2252(config)#
```

Command Line Processing

Commands are not case sensitive. You can abbreviate commands and parameters as long as they contain enough letters to differentiate them from any other currently available commands or parameters. You can use the Tab key to complete partial commands, or enter a partial command followed by the "?" character to display a list of possible matches. You can also use the following editing keystrokes for command-line processing:

Table 19-3. Keystroke Commands

Keystroke	Function
Ctrl-A	Shifts cursor to start of command line.
Ctrl-B	Shifts cursor to the left one character.
Ctrl-C	Terminates the current task and displays the command prompt.
Ctrl-E	Shifts cursor to end of command line.
Ctrl-F	Shifts cursor to the right one character.
Ctrl-K	Deletes all characters from the cursor to the end of the line.
Ctrl-L	Repeats current command line on a new line.
Ctrl-N	Enters the next command line in the history buffer.
Ctrl-P	Enters the last command.
Ctrl-R	Repeats current command line on a new line.
Ctrl-U	Deletes from the cursor to the beginning of the line.
Ctrl-W	Deletes the last word typed.
Esc-B	Moves the cursor back one word.
Esc-D	Deletes from the cursor to the end of the word.
Esc-F	Moves the cursor forward one word.
Delete key or backspace key	Erases a mistake when entering a command.

Showing Status Information

There are various "show" commands which display configuration settings or the status of specified processes. Many of these commands will not display any information unless the switch is properly configured, and in some cases the interface to which a command applies is up.

For example, if a static router port is configured, the corresponding show command will not display any information unless IGMP snooping is enabled, and the link for the static router port is up.

```
SSE-G2252#configure
SSE-G2252(config)#ip igmp snooping vlan 1 mrouter ethernet 1/11
SSE-G2252(config)#end
SSE-G2252#show ip igmp snooping mrouter
 VLAN M'cast Router Ports Type
 ---- ------------------- -------
SSE-G2252#configure
SSE-G2252(config)#ip igmp snooping
SSE-G2252(config)#end
SSE-G2252#show ip igmp snooping mrouter
 VLAN M'cast Router Ports Type
 ---- ------------------- -------
 1    Eth 1/11            Static
SSE-G2252#
```

Output Modifiers

Some of the show commands include options for output modifiers. For example, the “show running-config” command includes the following keyword options:

```
SSE-G2252#show running-config ?
| Output modifiers
<cr>
```

The output modifiers include options which indicate a string that occurs at the beginning of a line, in lines that are to be excluded, or in lines that are to be included.

```
SSE-G2252#show running-config | ?
begin    Begin with line that matches
exclude  Exclude lines that match
include  Include lines that match
```

Note that the output modifier `begin` can only be used as the first modifier if more than one modifier is used in a command.

19-3 CLI Command Groups

The system commands can be broken down into the functional groups shown below.

Table 19-4. Command Group Index

Command Group	Description	Page
General	Basic commands for entering privileged access mode, restarting the system, or quitting the CLI	page 20-1
System Management	Display and setting of system information, basic modes of operation, maximum frame size, file management, console port and telnet settings, system logs, SMTP alerts, the system clock, and switch clustering	page 21-1
Simple Network Management Protocol	Activates authentication failure traps; configures community access strings, and trap receivers	page 22-1
Remote Monitoring	Supports statistics, history, alarm and event groups	page 23-1
User Authentication	Configures user names and passwords, logon access using local or remote authentication, management access through the web server, Telnet server and Secure Shell; as well as port security, IEEE 802.1X port access control, and restricted access based on specified IP addresses	page 24-1
General Security Measures	Segregates traffic for clients attached to common data ports; and prevents unauthorized access by configuring valid static or dynamic addresses, web authentication, MAC address authentication, filtering DHCP requests and replies, and discarding invalid ARP responses	page 25-1
Access Control List	Provides filtering for IPv4 frames (based on address, protocol, TCP/UDP port number or TCP control code), or non-IP frames (based on MAC address or Ethernet type)	page 26-1

Table 19-4. Command Group Index (Continued)

Command Group	Description	Page
Interface	Configures the connection parameters for all Ethernet ports, aggregated links, and VLANs	page 27-1
Link Aggregation	Statically groups multiple ports into a single logical trunk; configures Link Aggregation Control Protocol for port trunks	page 28-1
Power over Ethernet	Configures power output for connected devices	page 29-1
Mirror Port	Mirrors data to another port for analysis without affecting the data passing through or the performance of the monitored port	page 30-1
Rate Limit	Controls the maximum rate for traffic transmitted or received on a port	page 31-1
Automatic Traffic Control	Configures bounding thresholds for broadcast and multicast storms which can be used to trigger configured rate limits or to shut down a port	page 32-1
Address Table	Configures the address table for filtering specified addresses, displays current entries, clears the table, or sets the aging time	page 33-1
Spanning Tree	Configures Spanning Tree settings for the switch	page 34-1
VLANs	Configures VLAN settings, and defines port membership for VLAN groups; also enables or configures private VLANs, protocol VLANs, voice VLANs, and QinQ tunneling	page 35-1
Class of Service	Sets port priority for untagged frames, selects strict priority or weighted round robin, relative weight for each priority queue, also sets priority for DSCP	page 36-1
Quality of Service	Configures Differentiated Services	page 37-1
Multicast Filtering	Configures IGMP multicast filtering, query, profile, and proxy parameters; specifies ports attached to a multicast router; also configures multicast VLAN registration	page 38-1
Link Layer Discovery Protocol	Configures LLDP settings to enable information discovery about neighbor devices	page 39-1
Domain Name Service	Configures DNS services.	page 40-1
Dynamic Host Configuration Protocol	Configures DHCP client functions	page 41-1
IP Interface	Configures IP address for the switch interfaces; also configures ARP parameters and static entries	page 42-1

The access mode shown in the following tables is indicated by these abbreviations:

ACL (Access Control List Configuration)

CM (Class Map Configuration)

GC (Global Configuration)

IC (Interface Configuration)

IPC (IGMP Profile Configuration)

LC (Line Configuration)

MST (Multiple Spanning Tree)

NE (Normal Exec)

PE (Privileged Exec)

PM (Policy Map Configuration)

VC (VLAN Database Configuration)

Notes

Chapter 20
General Commands

These commands are used to control the command access mode, configuration mode, and other basic functions.

Table 20-1. General Commands

Command	Function	Mode
prompt	Customizes the CLI prompt	GC
reload (Global Configuration)	Restarts the system at a specified time, after a specified delay, or at a periodic interval	GC
enable	Activates privileged mode	NE
quit	Exits a CLI session	NE, PE
show history	Shows the command history buffer	NE, PE
configure	Activates global configuration mode	PE
disable	Returns to normal mode from privileged mode	PE
reload (Privileged Exec)	Restarts the system immediately	PE
show reload	Displays the current reload settings, and the time at which next scheduled reload will take place	PE
end	Returns to Privileged Exec mode	any config. mode
exit	Returns to the previous configuration mode, or exits the CLI	any mode
help	Shows how to use help	any mode
?	Shows options for command completion (context sensitive)	any mode

prompt

This command customizes the CLI prompt. Use the **no** form to restore the default prompt.

Syntax

prompt *string*

no prompt

string - Any alphanumeric string to use for the CLI prompt. (Maximum length: 255 characters)

Default Setting

Console

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#prompt RD2
RD2(config)#
```

reload (Global Configuration)

This command restarts the system at a specified time, after a specified delay, or at a periodic interval. You can reboot the system immediately, or you can configure the switch to reset after a specified amount of time. Use the **cancel** option to remove a configured setting.

Syntax

reload {**at** *hour minute* [{*month day* | *day month*} [*year*]] |
in {**hour** *hours* | **minute** *minutes* | **hour** *hours* **minute** *minutes*} |
regularity *hour minute* [**period** {**daily** | **weekly** *day-of-week* | **monthly** *day*}] | **cancel** [**at** | **in** | **regularity**]}

reload at - A specified time at which to reload the switch.

hour - The hour at which to reload. (Range: 0-23)

minute - The minute at which to reload. (Range: 0-59)

month - The month at which to reload. (january ... december)

day - The day of the month at which to reload. (Range: 1-31)

year - The year at which to reload. (Range: 2001-2050)

reload in - An interval after which to reload the switch.

hours - The number of hours, combined with the minutes, before the switch resets. (Range: 0-576)

minutes - The number of minutes, combined with the hours, before the switch resets. (Range: 0-59)

reload regularity - A periodic interval at which to reload the switch.

hour - The hour at which to reload. (Range: 0-23)

minute - The minute at which to reload. (Range: 0-59)

day-of-week - Day of the week at which to reload. (Range: monday ... saturday)

day - Day of the month at which to reload. (Range: 1-31)

reload cancel - Cancels the specified reload option.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- This command resets the entire system.
- Any combination of reload options may be specified. If the same option is re-specified, the previous setting will be overwritten.
- When the system is restarted, it will always run the Power-On Self-Test. It will also retain all configuration information stored in non-volatile memory by the copy **running-config startup-config** command (See "copy" on page 21-15).

Example

This example shows how to reset the switch after 30 minutes:

```
SSE-G2252(config)#reload in minute 30
***
*** --- Rebooting at January  1 02:10:43 2007 ---
***

Are you sure to reboot the system at the specified time? <y/n>
```

enable

This command activates Privileged Exec mode. In privileged mode, additional commands are available, and certain commands display additional information. See "Understanding Command Modes" on page 19-6.

Syntax

enable [*level*]

level - Privilege level to log into the device.

The device has two predefined privilege levels: 0: Normal Exec, 15: Privileged Exec. Enter level 15 to access Privileged Exec mode.

Default Setting

Level 15

Command Mode

Normal Exec

Command Usage

- "super" is the default password required to change the command mode from Normal Exec to Privileged Exec. (To set this password, see the enable password command.)
- The "#" character is appended to the end of the prompt to indicate that the system is in privileged access mode.

Example

```
SSE-G2252>enable
Password: [privileged level password]
SSE-G2252#
```

Related Commands

"disable" on page 20-6

"enable password" on page 24-2

quit

This command exits the configuration program.

Default Setting

None

Command Mode

Normal Exec, Privileged Exec

Command Usage

The **quit** and **exit** commands can both exit the configuration program.

Example

This example shows how to quit a CLI session:

```
SSE-G2252#quit

Press ENTER to start session

User Access Verification

Username:
```

show history

This command shows the contents of the command history buffer.

Default Setting

None

Command Mode

Normal Exec, Privileged Exec

Command Usage

The history buffer size is fixed at 10 Execution commands and 10 Configuration commands.

Example

In this example, the show history command lists the contents of the command history buffer:

```
SSE-G2252#show history
Execution command history:
 2 config
 1 show history

Configuration command history:
 4 interface vlan 1
 3 exit
 2 interface vlan 1
 1 end

SSE-G2252#
```

The **!** command repeats commands from the Execution command history buffer when you are in Normal Exec or Privileged Exec Mode, and commands from the Configuration command history buffer when you are in any of the configuration modes. In this example, the **!2** command repeats the second command in the Execution history buffer (**config**).

```
SSE-G2252#!2
SSE-G2252#config
SSE-G2252(config)#
```

configure

This command activates Global Configuration mode. You must enter this mode to modify any settings on the switch. You must also enter Global Configuration mode prior to enabling some of the other configuration modes, such as Interface Configuration, Line Configuration, and VLAN Database Configuration. See "Understanding Command Modes" on page 19-6.

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#configure
SSE-G2252(config)#
```

Related Commands

"end" on page 20-7

disable

This command returns to Normal Exec mode from privileged mode. In normal access mode, you can only display basic information on the switch's configuration or Ethernet statistics. To gain access to all commands, you must use the privileged mode. See "Understanding Command Modes" on page 19-6.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

The ">" character is appended to the end of the prompt to indicate that the system is in normal access mode.

Example

```
SSE-G2252#disable
SSE-G2252>
```

Related Commands

"enable" on page 20-3

reload (Privileged Exec)

This command restarts the system.

NOTE: When the system is restarted, it will always run the Power-On Self-Test. It will also retain all configuration information stored in non-volatile memory by the copy running-config startup-config command.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

This command resets the entire system.

Example

This example shows how to reset the switch:

```
SSE-G2252#reload
System will be restarted, continue <y/n>? y
```

show reload

This command displays the current reload settings, and the time at which next scheduled reload will take place.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show reload
Reloading switch in time:                       0 hours 29 minutes.

The switch will be rebooted at January  1 02:11:50 2001.
Remaining Time: 0 days, 0 hours, 29 minutes, 52 seconds.
SSE-G2252#
```

end

This command returns to Privileged Exec mode.

Default Setting

None

Command Mode

Global Configuration, Interface Configuration, Line Configuration, VLAN Database Configuration, and Multiple Spanning Tree Configuration.

Example

This example shows how to return to the Privileged Exec mode from the Interface Configuration mode:

```
SSE-G2252(config-if)#end
SSE-G2252#
```

exit

This command returns to the previous configuration mode or exits the configuration program.

Default Setting

None

Command Mode

Any

Example

This example shows how to return to the Privileged Exec mode from the Global Configuration mode, and then quit the CLI session:

```
SSE-G2252(config)#exit
SSE-G2252#exit

Press ENTER to start session

User Access Verification

Username:
```

Chapter 21
System Management Commands

These commands are used to control system logs, passwords, user names, management options, and display or configure a variety of other system information.

Table 21-1. System Management Commands

Command Group	Function
Device Designation	Configures information that uniquely identifies this switch
System Status	Displays system configuration, active managers, and version information
Frame Size	Enables support for jumbo frames
File Management	Manages code image or switch configuration files
Line	Sets communication parameters for the serial port, including baud rate and console time-out
Event Logging	Controls logging of error messages
SMTP Alerts	Configures SMTP email alerts
Time (System Clock)	Sets the system clock automatically via NTP/SNTP server or manually
Time Range	Sets a time range for use by other functions, such as Access Control Lists
Switch Clustering	Configures management of multiple devices via a single IP address

21-1 Device Designation

This section describes commands used to configure information that uniquely identifies the switch.

Table 21-2. Device Designation Commands

Command	Function	Mode
hostname	Specifies the host name for the switch	GC
snmp-server contact	Sets the system contact string	GC
snmp-server location	Sets the system location string	GC

hostname

This command specifies or modifies the host name for this device. Use the **no** form to restore the default host name.

Syntax

hostname *name*

no hostname

name - The name of this host. (Maximum length: 255 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#hostname RD#1
SSE-G2252(config)#
```

21-2 System Status

This section describes commands used to display system information.

Table 21-3. System Status Commands

Command	Function	Mode
show access-list tcam-utilization	Shows utilization parameters for TCAM	PE
show memory	Shows memory utilization parameters	NE, PE
show process cpu	Shows CPU utilization parameters	NE, PE
show running-config	Displays the configuration data currently in use	PE
show startup-config	Displays the contents of the configuration file (stored in flash memory) that is used to start up the system	PE
show system	Displays system information	NE, PE
show tech-support	Displays a detailed list of system settings designed to help technical support resolve configuration or functional problems	PE
show users	Shows all active console and Telnet sessions, including user name, idle time, and IP address of Telnet clients	NE, PE
show version	Displays version information for the system	NE, PE

show access-list tcam-utilization

This command shows utilization parameters for TCAM (Ternary Content Addressable Memory), including the number policy control entries in use, the number of free entries, and the overall percentage of TCAM in use.

Command Mode

Privileged Exec

Command Usage

Policy control entries (PCEs) are used by various system functions which rely on rule-based searches, including Access Control Lists (ACLs), IP Source Guard filter rules, Quality of Service (QoS) processes, or traps.

For example, when binding an ACL to a port, each rule in an ACL will use two PCEs; and when setting an IP Source Guard filter rule for a port, the system will also use two PCEs.

Example

```
SSE-G2252#show access-list tcam-utilization
  Total Policy Control Entries   : 512
  Free Policy Control Entries    : 352
  Entries Used by System         : 160
  Entries Used by User           : 0
  TCAM Utilization               : 31.25%
SSE-G2252#
```

show memory

This command shows memory utilization parameters.

Command Mode

Normal Exec, Privileged Exec

Command Usage

This command shows the amount of memory currently free for use, the amount of memory allocated to active processes, and the total amount of system memory.

Example

```
SSE-G2252#show memory
 Status   Bytes
 ------ ----------
 Free     50917376
 Used     83300352
Total    134217728

SSE-G2252#
```

show process cpu

This command shows the CPU utilization parameters.

Command Mode

Normal Exec, Privileged Exec

Example

```
SSE-G2252#show process cpu
 CPU Utilization in the past 5 seconds : 3.98%
SSE-G2252#
```

show running-config

This command displays the configuration information currently in use.

Command Mode

Privileged Exec

Command Usage

- Use this command in conjunction with the **show startup-config** command to compare the information in running memory to the information stored in non-volatile memory.
- This command displays settings for key command modes. Each mode group is separated by "!" symbols, and includes the configuration mode command, and corresponding commands. This command displays the following information:
  - MAC address for the switch
  - SNTP server settings
  - SNMP community strings
  - Users (names, access levels, and encrypted passwords)
  - VLAN database (VLAN ID, name and state)
  - VLAN configuration settings for each interface
  - Multiple spanning tree instances (name and interfaces)
  - IP address configured for management VLAN
  - Layer 4 precedence settings
  - Spanning tree settings
  - Interface settings
  - Any configured settings for the console port and Telnet

Example

```
SSE-G2252#show running-config
Building startup configuration. Please wait...
!<stackingDB>00</stackingDB>
!<stackingMac>01_00-e0-0c-00-00-fd_00</stackingMac>
!
snmp-server community public ro
snmp-server community private rw
!
snmp-server enable traps authentication
!
username admin access-level 15
username admin password 7 21232f297a57a5a743894a0e4a801fc3
username guest access-level 0
username guest password 7 084e0343a0486ff05530df6c705c8bb4
enable password level 15 7 1b3231655cebb7a1f783eddf27d254ca
!
vlan database
 vlan 1 name DefaultVlan media ethernet state active
!
spanning-tree mst configuration
```

```
!
interface ethernet 1/1
 switchport allowed vlan add 1 untagged
 switchport native vlan 1


 qos map dscp-mutation 6 0 from 46
.
.
.

!
interface vlan 1
 ip address 192.168.100.102 255.255.255.0
!
 queue mode strict-wrr 0 0 0 1
!
line console
!
line vty
!
end
!
SSE-G2252#
```

Related Commands

"show startup-config" on page 21-7

show startup-config

This command displays the configuration file stored in non-volatile memory that is used to start up the system.

Command Mode

Privileged Exec

Command Usage

- Use this command in conjunction with the **show running-config** command to compare the information in running memory to the information stored in non-volatile memory.
- This command displays settings for key command modes. Each mode group is separated by “!” symbols, and includes the configuration mode command, and corresponding commands. This command displays the following information:
  - MAC address for the switch
  - SNMP community strings
  - SNMP trap authentication
  - RMON alarms settings
  - Users (names and access levels)
  - VLAN database (VLAN ID, name and state)
  - Multiple spanning tree instances (name and interfaces)
  - Interface settings and VLAN configuration settings for each interface
  - IP address for management VLAN
  - Any configured settings for the console port and Telnet

Example

Refer to the example for the running configuration file.

Related Commands

"show running-config" on page 21-4

show system

This command displays system information.

Default Setting

None

Command Mode

Normal Exec, Privileged Exec

Command Usage

- For a description of the items shown by this command, refer to Section 5-1: "Displaying System Information" on page 5-1.
- The number of fans provided: SSE-G2252 - 1, SSE-G2252P - 3
- The POST results should all display "PASS." If any POST test indicates "FAIL," contact your distributor for assistance.

Example

```
SSE-G2252#show system
System Description : SSE-G2252 Managed FE Switch
System OID String  : 1.3.6.1.4.1.572.17389.202
System Information
 System Up Time         : 0 days, 7 hours, 20 minutes, and 43.30 seconds
 System Name            :
 System Location        :
 System Contact         :
 MAC Address (Unit 1)   : 00-E0-0C-00-00-FD
 Web Server             : Enabled
 Web Server Port        : 80
 Web Secure Server      : Enabled
 Web Secure Server Port : 443
 Telnet Server          : Enabled
 Telnet Server Port     : 23
 Jumbo Frame            : Disabled

System Fan:
Unit 1

 POST Result:

SSE-G2252#
```

show tech-support

This command displays a detailed list of system settings designed to help technical support resolve configuration or functional problems.

Command Mode

Normal Exec, Privileged Exec

Command Usage

This command generates a long list of information including detailed system and interface settings. It is therefore advisable to direct the output to a file using any suitable output capture function provided with your terminal emulation program.

Example

```
Console#show tech-support

Show System:
System Description : SSE-G2252 Managed FE Switch
System OID String  : 1.3.6.1.4.1.572.17389.202
System Information
 System Up Time         : 0 days, 1 hours, 28 minutes, and 51.70 seconds
 System Name            :
 System Location        :
 System Contact         :
 MAC Address (Unit 1)   : 00-E0-0C-00-00-FD
 Web Server             : Enabled
 Web Server Port        : 80
 Web Secure Server      : Disabled
 Web Secure Server Port : 443
 Telnet Server          : Enabled
 Telnet Server Port     : 23
 Jumbo Frame            : Disabled
.
.
.
```

show users

Shows all active console and Telnet sessions, including user name, idle time, and IP address of Telnet client.

Default Setting

None

Command Mode

Normal Exec, Privileged Exec

Command Usage

The session used to execute this command is indicated by a "*" symbol next to the Line (i.e., session) index number.

Example

```
SSE-G2252#show users
 User Name Accounts:
  User Name Privilege Public-Key
  --------- --------- ----------
      admin        15 None
      guest         0 None
      steve        15  RSA

 Online Users:
  Line        Username Idle time (h:m:s) Remote IP addr.
  ----------- -------- ----------------- ---------------
  0   console    admin           0:14:14
* 1     VTY 0    admin           0:00:00    192.168.1.19
  2     SSH 1    steve           0:00:06    192.168.1.19

 Web Online Users:
  Line        Remote IP Addr  User Name Idle time (h:m:s)
  ----------- --------------- --------- ------------------
  1      HTTP    192.168.1.19     admin            0:00:0
SSE-G2252#
```

show version

This command displays hardware and software version information for the system.

Command Mode

Normal Exec, Privileged Exec

Command Usage

See Section 5-2: "Displaying Switch Hardware/Software Versions" on page 5-2 for detailed information on the items displayed by this command.

Example

```
SSE-G2252#show version
Unit 1
 Serial Number          : S123456
 Hardware Version       : R0A
 EPLD Version           : 0.00
 Number of Ports        : 50
 Main Power Status      : Up
 Redundant Power Status : Not present
 Role                   : Master
 Loader Version         : 1.0.1.5
 Linux Kernel Version   : 2.6.22.18
 Boot ROM Version       : 0.0.0.1
 Operation Code Version : 0.0.2.0

SSE-G2252#
```

21-3 Frame Size

This section describes commands used to configure the Ethernet frame size on the switch.

Table 21-4. Frame Size Commands

Command	Function	Mode
jumbo frame	Enables support for jumbo frames	GC

jumbo frame

This command enables support for jumbo frames for Gigabit Ethernet ports. Use the **no** form to disable it.

Syntax

[**no**] **jumbo frame**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- This switch provides more efficient throughput for large sequential data transfers by supporting jumbo frames on Gigabit Ethernet ports up to 10240 bytes. Compared to standard Ethernet frames that run only up to 1.5 KB, using jumbo frames significantly reduces the per-packet overhead required to process protocol encapsulation fields.
- To use jumbo frames, both the source and destination end nodes (such as a computer or server) must support this feature. Also, when the connection is operating at full duplex, all switches in the network between the two end nodes must be able to accept the extended frame size. And for half-duplex connections, all devices in the collision domain would need to support jumbo frames.
- The current setting for jumbo frames can be displayed with the show system command.

Example

```
SSE-G2252(config)#jumbo frame
SSE-G2252(config)#
```

21-4 File Management

Managing Firmware

Firmware can be uploaded and downloaded to or from an FTP/TFTP server. By saving runtime code to a file on an FTP/TFTP server, that file can later be downloaded to the switch to restore operation. The switch can also be set to use new firmware without overwriting the previous version.

When downloading runtime code, the destination file name can be specified to replace the current image, or the file can be first downloaded using a different name from the current runtime code file, and then the new file set as the startup file.

Saving or Restoring Configuration Settings

Configuration settings can be uploaded and downloaded to and from an FTP/TFTP server. The configuration file can be later downloaded to restore switch settings.

The configuration file can be downloaded under a new file name and then set as the startup file, or the current startup configuration file can be specified as the destination file to directly replace it. Note that the file “Factory_Default_Config.cfg” can be copied to the FTP/TFTP server, but cannot be used as the destination on the switch.

Table 21-5. Flash/File Commands

Command	Function	Mode
boot system	Specifies the file or image used to start up the system	GC
copy	Copies a code image or a switch configuration to or from flash memory or an FTP/TFTP server	PE
delete	Deletes a file or code image	PE
dir	Displays a list of files in flash memory	PE
whichboot	Displays the files booted	PE
Automatic Code Upgrade Commands		
upgrade opcode auto	Automatically upgrades the current image when a new version is detected on the indicated server	GC
upgrade opcode path	Specifies an FTP/TFTP server and directory in which the new opcode is stored	GC

boot system

This command specifies the file or image used to start up the system.

Syntax

boot system {**boot-rom** | **config** | **opcode**}: *filename*

boot-rom[1] - Boot ROM.

config[1] - Configuration file.

opcode[1] - Run-time operation code.

filename - Name of configuration file or code image.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- A colon (:) is required after the specified file type.
- If the file contains an error, it cannot be set as the default file.

Example

```
SSE-G2252(config)#boot system config: startup
SSE-G2252(config)#
```

Related Commands

"dir" on page 21-18

"whichboot" on page 21-20

1. The colon (:) is required.

copy

This command moves (upload/download) a code image or configuration file between the switch's flash memory and an FTP/TFTP server. When you save the system code or configuration settings to a file on an FTP/TFTP server, that file can later be downloaded to the switch to restore system operation. The success of the file transfer depends on the accessibility of the FTP/TFTP server and the quality of the network connection.

Syntax

copy file {file | ftp | running-config | startup-config | tftp}
copy running-config {file | ftp | startup-config | tftp}
copy startup-config {file | ftp | running-config | tftp}
copy tftp {file | public-key |
running-config | startup-config}

file - Keyword that allows you to copy to/from a file.

ftp - Keyword that allows you to copy to/from an FTP server.

public-key - Keyword that allows you to copy a SSH key from a TFTP server. (Section 24-8: "Secure Shell" on page 24-34)

running-config - Keyword that allows you to copy to/from the current running configuration.

startup-config - The configuration used for system initialization.

tftp - Keyword that allows you to copy to/from a TFTP server.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- The system prompts for data required to complete the copy command.
- The destination file name should not contain slashes (\ or /), and the maximum length for file names is 32 characters for files on the switch or 128 characters for files on the server. (Valid characters: A-Z, a-z, 0-9, ".", "-")
- The switch supports only two operation code files, but the maximum number of user-defined configuration files is 16.
- You can use "Factory_Default_Config.cfg" as the source to copy from the factory default configuration file, but you cannot use it as the destination.
- To replace the startup configuration, you must use **startup-config** as the destination.

- The Boot ROM and Loader cannot be uploaded or downloaded from the FTP/TFTP server. You must follow the instructions in the release notes for new firmware, or contact your distributor for help.
- When logging into an FTP server, the interface prompts for a user name and password configured on the remote server. Note that "anonymous" is set as the default user name.

Example

The following example shows how to download new firmware from a TFTP server:

```
SSE-G2252#copy tftp file
TFTP server ip address: 10.1.0.19
Choose file type:
 1. config:  2. opcode: <1-2>: 2
Source file name: m360.bix
Destination file name: m360.bix
\Write to FLASH Programming.
-Write to FLASH finish.
Success.
SSE-G2252#
```

The following example shows how to upload the configuration settings to a file on the TFTP server:

```
SSE-G2252#copy file tftp
Choose file type:
 1. config:  2. opcode: <1-2>: 1
Source file name: startup
TFTP server ip address: 10.1.0.99
Destination file name: startup.01
TFTP completed.
Success.

SSE-G2252#
```

The following example shows how to copy the running configuration to a startup file.

```
SSE-G2252#copy running-config file
destination file name: startup
Write to FLASH Programming.
\Write to FLASH finish.
Success.

SSE-G2252#
```

The following example shows how to download a configuration file:

```
SSE-G2252#copy tftp startup-config
TFTP server ip address: 10.1.0.99
Source configuration file name: startup.01
Startup configuration file name [startup]:
Write to FLASH Programming.

\Write to FLASH finish.
Success.

SSE-G2252#
SSE-G2252#copy tftp https-certificate
```

```
TFTP server ip address: 10.1.0.19
Source certificate file name: SS-certificate
Source private file name: SS-private
Private password: ********

Success.
SSE-G2252#reload
System will be restarted, continue <y/n>? y
```

This example shows how to copy a public-key used by SSH from an TFTP server. Note that public key authentication via SSH is only supported for users configured locally on the switch.

```
SSE-G2252#copy tftp public-key
TFTP server IP address: 192.168.1.19
Choose public key type:
 1. RSA:  2. DSA: <1-2>: 1
Source file name: steve.pub
Username: steve
TFTP Download
Success.
Write to FLASH Programming.
Success.

SSE-G2252#
```

This example shows how to copy a file to an FTP server.

```
Console#copy ftp file
FTP server IP address: 169.254.1.11
User[anonymous]: admin
Password[]: *****
Choose file type:
 1. config:  2. opcode: 2
Source file name: BLANC.BIX
Destination file name: BLANC.BIX
Console#
```

delete

This command deletes a file or image.

Syntax

delete *filename*

filename - Name of configuration file or code image.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- If the file type is used for system startup, then this file cannot be deleted.
- "Factory_Default_Config.cfg" cannot be deleted.

Example

This example shows how to delete the test2.cfg configuration file from flash memory.

```
SSE-G2252#delete test2.cfg
SSE-G2252#
```

Related Commands

"dir" on page 21-18

"delete public-key" on page 24-40

dir

This command displays a list of files in flash memory.

Syntax

dir {boot-rom: | config: | opcode:} [*filename*]}

boot-rom - Boot ROM (or diagnostic) image file.

config - Switch configuration file.

opcode - Run-time operation code image file.

filename - Name of configuration file or code image. If this file exists but contains errors, information on this file cannot be shown.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- If you enter the command **dir** without any parameters, the system displays all files.

  File information is shown below:

Table 21-6. File Directory Information

Column Heading	Description
File Name	The name of the file.
File Type	File types: Boot-Rom, Operation Code, and Config file.
Startup	Shows if this file is used when the system is started.
Create Time	The date and time the file was created.
Size	The length of the file in bytes.

Example

The following example shows how to display all file information:

```
SSE-G2252#dir
        File Name                   Type  Startup Modify Time
Size(bytes)
-------------------------- -------------- ------- -------------
 Unit 1:
SSE-G2252_Op_V0.0.1.0.bix        OpCode     N    2010-04-06 13:26:15
10299584
SSE-G2252_Op_V0.0.2.0.bix        OpCode     Y    2010-06-30 05:51:48
11068480
Factory_Default_Config.cfg      Config     N    2010-04-02 11:20:49
509
startup1.cfg                    Config     Y    2010-06-30 05:48:16
3484
 ------------------------------------------------------------
                        Free space for compressed user config files:
745472
SSE-G2252#
```

whichboot

This command displays which files were booted when the system powered up.

Syntax

whichboot

Default Setting

None

Command Mode

Privileged Exec

Example

This example shows the information displayed by the **whichboot** command. See the table under the **dir** command for a description of the file information displayed by this command.

```
SSE-G2252#whichboot
        File Name                   Type  Startup Modify Time
Size(bytes)
-------------------------------- ------- ------- --------------
 Unit 1:
SSE-G2252_Op_V0.0.2.0.bix         OpCode     Y    2010-06-30 05:51:48
11068480
startup1.cfg                     Config     Y    2010-06-30 05:48:16
3484

SSE-G2252#
```

upgrade opcode auto

This command automatically upgrades the current operational code when a new version is detected on the server indicated by the upgrade opcode path command. Use the **no** form of this command to restore the default setting.

Syntax

[no] upgrade opcode auto

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- This command is used to enable or disable automatic upgrade of the operational code. When the switch starts up and automatic image upgrade is enabled by this command, the switch will follow these steps when it boots up:

1. It will search for a new version of the image at the location specified by upgrade opcode path command ("upgrade opcode path" on page 21-22). The name for the new image stored on the TFTP server must be SSE-G2252_Op.bix. If the switch detects a code version newer than the one currently in use, it will download the new image. If two code images are already stored in the switch, the image not set to start up the system will be overwritten by the new version.
2. After the image has been downloaded, the switch will send a trap message to log whether or not the upgrade operation was successful.
3. It sets the new version as the startup image.
4. It then restarts the system to start using the new image.

- Any changes made to the default setting can be displayed with the "show running-config" on page 21-4 or "show startup-config" on page 21-7 commands.

Example

```
SSE-G2252(config)#upgrade opcode auto
SSE-G2252(config)#upgrade opcode path tftp://192.168.0.1/sm24/
SSE-G2252(config)#
```

If a new image is found at the specified location, the following type of messages will be displayed during bootup.

```
.
.
.
Automatic Upgrade is looking for a new image
New image detected: current version 0.0.1.0; new version 0.0.2.0
Image upgrade in progress
The switch will restart after upgrade succeeds
Downloading new image
Flash programming started
Flash programming completed
The switch will now restart
.
.
.
```

upgrade opcode path

This command specifies an TFTP server and directory in which the new opcode is stored. Use the **no** form of this command to clear the current setting.

Syntax

upgrade opcode path *opcode-dir-url*

no upgrade opcode path

opcode-dir-url - The location of the new code.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- This command is used in conjunction with the upgrade opcode auto command to facilitate automatic upgrade of new operational code stored at the location indicated by this command.
- The name for the new image stored on the TFTP server must be SSE-G2252_Op.bix. However, note that file name is not to be included in this command.
- When specifying a TFTP server, the following syntax must be used, where *filedir* indicates the path to the directory containing the new image:

  `tftp://192.168.0.1[/filedir]/`
- When specifying an FTP server, the following syntax must be used, where *filedir* indicates the path to the directory containing the new image:

  `ftp://[username[:password@]]192.168.0.1[/filedir]/`
  If the user name is omitted, "anonymous" will be used for the connection. If the password is omitted a null string ("") will be used for the connection.

Example

This shows how to specify a TFTP server where new code is stored.

```
SSE-G2252(config)#upgrade opcode path tftp://192.168.0.1/sm24/
SSE-G2252(config)#
```

This shows how to specify an FTP server where new code is stored.

```
SSE-G2252(config)#upgrade opcode path ftp://admin:billy@192.168.0.1/sm24/
SSE-G2252(config)#
```

21-5 Line

You can access the onboard configuration program by attaching a VT100 compatible device to the server's serial port. These commands are used to set communication parameters for the serial port or Telnet (i.e., a virtual terminal).

Table 21-7. Line Commands

Command	Function	Mode
line	Identifies a specific line for configuration and starts the line configuration mode	GC
accounting exec	Applies an accounting method to local console, Telnet or SSH connections	LC
authorization exec	Applies an authorization method to local console, Telnet or SSH connections	LC
databits[a]	Sets the number of data bits per character that are interpreted and generated by hardware	LC
exec-timeout	Sets the interval that the command interpreter waits until user input is detected	LC
login	Enables password checking at login	LC
parity[a]	Defines the generation of a parity bit	LC
password	Specifies a password on a line	LC
password-thresh	Sets the password intrusion threshold, which limits the number of failed logon attempts	LC
silent-time[a]	Sets the amount of time the management console is inaccessible after the number of unsuccessful logon attempts exceeds the threshold set by the password-thresh command	LC
speed[a]	Sets the terminal baud rate	LC
stopbits[a]	Sets the number of the stop bits transmitted per byte	LC
timeout login response	Sets the interval that the system waits for a login attempt	LC
disconnect	Terminates a line connection	PE
show line	Displays a terminal line's parameters	NE, PE

a. These commands only apply to the serial port.

line

This command identifies a specific line for configuration, and to process subsequent line configuration commands.

Syntax

line {console | vty}

console - Console terminal line.

vty - Virtual terminal for remote console access (i.e., Telnet).

Default Setting

There is no default line.

Command Mode

Global Configuration

Command Usage

Telnet is considered a virtual terminal connection and will be shown as "VTY" in screen displays such as show users. However, the serial communication parameters (e.g., databits) do not affect Telnet connections.

Example

To enter console line mode, enter the following command:

```
SSE-G2252(config)#line console
SSE-G2252(config-line)#
```

Related Commands

"show line" on page 21-36

"show users" on page 21-10

databits

This command sets the number of data bits per character that are interpreted and generated by the console port. Use the **no** form to restore the default value.

Syntax

databits {7 | 8}

no databits

7 - Seven data bits per character.

8 - Eight data bits per character.

Default Setting

8 data bits per character

Command Mode

Line Configuration

Command Usage

The **databits** command can be used to mask the high bit on input from devices that generate 7 data bits with parity. If parity is being generated, specify 7 data bits per character. If no parity is required, specify 8 data bits per character.

Example

To specify 7 data bits, enter this command:

```
SSE-G2252(config-line)#databits 7
SSE-G2252(config-line)#
```

Related Commands

"parity" on page 21-28

exec-timeout

This command sets the interval that the system waits until user input is detected. Use the **no** form to restore the default.

Syntax

exec-timeout [*seconds*]

no exec-timeout

seconds - Integer that specifies the timeout interval. (Range: 0 - 65535 seconds; 0: no timeout)

Default Setting

CLI: No timeout

Telnet: 10 minutes

Command Mode

Line Configuration

Command Usage

- If user input is detected within the timeout interval, the session is kept open; otherwise the session is terminated.
- This command applies to both the local console and Telnet connections.
- The timeout for Telnet cannot be disabled.
- Using the command without specifying a timeout restores the default setting.

Example

To set the timeout to two minutes, enter this command:

```
SSE-G2252(config-line)#exec-timeout 120
SSE-G2252(config-line)#
```

login

This command enables password checking at login. Use the **no** form to disable password checking and allow connections without a password.

Syntax

login [local]

no login

local - Selects local password checking. Authentication is based on the user name specified with the username command.

Default Setting

login local

Command Mode

Line Configuration

Command Usage

- There are three authentication modes provided by the switch itself at login:
- **login** selects authentication by a single global password as specified by the password line configuration command. When using this method, the management interface starts in Normal Exec (NE) mode.
- **login local** selects authentication via the user name and password specified by the username command (i.e., default setting). When using this method, the management interface starts in Normal Exec (NE) or Privileged Exec (PE) mode, depending on the user's privilege level (0 or 15 respectively).
- **no login** selects no authentication. When using this method, the management interface starts in Normal Exec (NE) mode.
- This command controls login authentication via the switch itself. To configure user names and passwords for remote authentication servers, you must use the RADIUS or TACACS software installed on those servers.

Example

```
SSE-G2252(config-line)#login local
SSE-G2252(config-line)#
```

Related Commands

"username" on page 24-3

"password" on page 21-29

parity

This command defines the generation of a parity bit. Use the **no** form to restore the default setting.

Syntax

parity {**none** | **even** | **odd**}

no parity

none - No parity

even - Even parity

odd - Odd parity

Default Setting

No parity

Command Mode

Line Configuration

Command Usage

Communication protocols provided by devices such as terminals and modems often require a specific parity bit setting.

Example

To specify no parity, enter this command:

```
SSE-G2252(config-line)#parity none
SSE-G2252(config-line)#
```

password

This command specifies the password for a line. Use the **no** form to remove the password.

Syntax

password {0 | 7} *password*

no password

{**0** | **7**} - 0 means plain password, 7 means encrypted password

password - Character string that specifies the line password. (Maximum length: 8 characters plain text, 32 encrypted, case sensitive)

Default Setting

No password is specified.

Command Mode

Line Configuration

Command Usage

- When a connection is started on a line with password protection, the system prompts for the password. If you enter the correct password, the system shows a prompt. You can use the password-thresh command to set the number of times a user can enter an incorrect password before the system terminates the line connection and returns the terminal to the idle state.
- The encrypted password is required for compatibility with legacy password settings (i.e., plain text or encrypted) when reading the configuration file during system bootup or when downloading the configuration file from a TFTP server. There is no need for you to manually configure encrypted passwords.

Example

```
SSE-G2252(config-line)#password 0 secret
SSE-G2252(config-line)#
```

Related Commands

"login" on page 21-27

"password-thresh" on page 21-30

password-thresh

This command sets the password intrusion threshold which limits the number of failed logon attempts. Use the **no** form to remove the threshold value.

Syntax

password-thresh [*threshold*]

no password-thresh

threshold - The number of allowed password attempts. (Range: 1-120; 0: no threshold)

Default Setting

The default value is three attempts.

Command Mode

Line Configuration

Command Usage

When the logon attempt threshold is reached, the system interface becomes silent for a specified amount of time before allowing the next logon attempt. (Use the silent-time command to set this interval.) When this threshold is reached for Telnet, the Telnet logon interface shuts down.

Example

To set the password threshold to five attempts, enter this command:

```
SSE-G2252(config-line)#password-thresh 5
SSE-G2252(config-line)#
```

Related Commands

"silent-time" on page 21-31

silent-time

This command sets the amount of time the management console is inaccessible after the number of unsuccessful logon attempts exceeds the threshold set by the password-thresh command. Use the **no** form to remove the silent time value.

Syntax

silent-time [*seconds*]

no silent-time

seconds - The number of seconds to disable console response. (Range: 0-65535; 0: 30 seconds)

Default Setting

The default value is no silent-time.

Command Mode

Line Configuration

Example

To set the silent time to 60 seconds, enter this command:

```
SSE-G2252(config-line)#silent-time 60
SSE-G2252(config-line)#
```

Related Commands

"password-thresh" on page 21-30

speed

This command sets the terminal line's baud rate. This command sets both the transmit (to terminal) and receive (from terminal) speeds. Use the **no** form to restore the default setting.

Syntax

speed *bps*

no speed

bps - Baud rate in bits per second. (Options: 9600, 19200, 38400, 57600, 115200 bps, or auto)

Default Setting

9600 bps

Command Mode

Line Configuration

Command Usage

Set the speed to match the baud rate of the device connected to the serial port. Some baud rates available on devices connected to the port might not be supported. The system indicates if the speed you selected is not supported. If you select the "auto" option, the switch will automatically detect the baud rate configured on the attached terminal, and adjust the speed accordingly.

NOTE: Due to a hardware limitation, the terminal program connected to the console port must be set to 8 data bits when using auto baud rate detection.

Example

To specify 57600 bps, enter this command:

```
SSE-G2252(config-line)#speed 57600
SSE-G2252(config-line)#
```

stopbits

This command sets the number of the stop bits transmitted per byte. Use the **no** form to restore the default setting.

Syntax

stopbits {**1** | **2**}

no stopbits

1 - One stop bit

2 - Two stop bits

Default Setting

1 stop bit

Command Mode

Line Configuration

Example

To specify 2 stop bits, enter this command:

```
SSE-G2252(config-line)#stopbits 2
SSE-G2252(config-line)#
```

timeout login response

This command sets the interval that the system waits for a user to log into the CLI. Use the **no** form to restore the default setting.

Syntax

timeout login response [*seconds*]

no timeout login response

seconds - Integer that specifies the timeout interval.
(Range: 0 - 300 seconds; 0: disabled)

Default Setting

CLI: Disabled (0 seconds)

Telnet: 300 seconds

Command Mode

Line Configuration

Command Usage

- If a login attempt is not detected within the timeout interval, the connection is terminated for the session.
- This command applies to both the local console and Telnet connections.
- The timeout for Telnet cannot be disabled.
- Using the command without specifying a timeout restores the default setting.

Example

To set the timeout to two minutes, enter this command:

```
SSE-G2252(config-line)#timeout login response 120
SSE-G2252(config-line)#
```

disconnect

This command terminates an SSH, Telnet, or console connection.

Syntax

disconnect *session-id*

session-id – The session identifier for an SSH, Telnet or console connection. (Range: 0-4)

Command Mode

Privileged Exec

Command Usage

Specifying session identifier “0” will disconnect the console connection. Specifying any other identifiers for an active session will disconnect an SSH or Telnet connection.

Example

```
SSE-G2252#disconnect 1
SSE-G2252#
```

Related Commands

"show ssh" on page 24-44

"show users" on page 21-10

show line

This command displays the terminal line's parameters.

Syntax

show line [console | vty]

console - Console terminal line.

vty - Virtual terminal for remote console access (i.e., Telnet).

Default Setting

Shows all lines

Command Mode

Normal Exec, Privileged Exec

Example

To show all lines, enter this command:

```
SSE-G2252#show line
 Console Configuration:
  Password Threshold : 3 times
  Inactive Timeout   : Disabled
  Login Timeout      : Disabled
  Silent Time        : Disabled
  Baud Rate          : Auto
  Data Bits          : 8
  Parity             : None
  Stop Bits          : 1

 VTY Configuration:
  Password Threshold : 3 times
  Inactive Timeout   : 600 sec.
  Login Timeout      : 300 sec.
SSE-G2252#
```

21-6 Event Logging

This section describes commands used to configure event logging on the switch.

Table 21-8. Event Logging Commands

Command	Function	Mode
logging facility	Sets the facility type for remote logging of syslog messages	GC
logging history	Limits syslog messages saved to switch memory based on severity	GC
logging host	Adds a syslog server host IP address that will receive logging messages	GC
logging on	Controls logging of error messages	GC
logging trap	Limits syslog messages saved to a remote server based on severity	GC
clear log	Clears messages from the logging buffer	PE
show log	Displays log messages	PE
show logging	Displays the state of logging	PE

logging facility

This command sets the facility type for remote logging of syslog messages. Use the **no** form to return the type to the default.

Syntax

logging facility *type*

no logging facility

type - A number that indicates the facility used by the syslog server to dispatch log messages to an appropriate service. (Range: 16-23)

Default Setting

23

Command Mode

Global Configuration

Command Usage

The command specifies the facility type tag sent in syslog messages. (See RFC 3164.) This type has no effect on the kind of messages reported by the switch. However, it may be used by the syslog server to sort messages or to store messages in the corresponding database.

Example

```
SSE-G2252(config)#logging facility 19
SSE-G2252(config)#
```

logging history

This command limits syslog messages saved to switch memory based on severity. The ***no*** form returns the logging of syslog messages to the default level.

Syntax

logging history {**flash** | **ram**} *level*

no logging history {**flash** | **ram**}

flash - Event history stored in flash memory (i.e., permanent memory).

ram - Event history stored in temporary RAM (i.e., memory flushed on power reset).

level - One of the levels listed below. Messages sent include the selected level down to level 0. (Range: 0-7)

Table 21-9. Logging Levels

Level	Severity Name	Description
7	debugging	Debugging messages
6	informational	Informational messages only
5	notifications	Normal but significant condition, such as cold start
4	warnings	Warning conditions (e.g., return false, unexpected return)
3	errors	Error conditions (e.g., invalid input, default used)
2	critical	Critical conditions (e.g., memory allocation, or free memory error - resource exhausted)
1	alerts	Immediate action needed
0	emergencies	System unusable

Default Setting

Flash: errors (level 3 - 0)

RAM: debugging (level 7 - 0)

Command Mode

Global Configuration

Command Usage

The message level specified for flash memory must be a higher priority (i.e., numerically lower) than that specified for RAM.

Example

```
SSE-G2252(config)#logging history ram 0
SSE-G2252(config)#
```

logging host

This command adds a syslog server host IP address that will receive logging messages. Use the **no** form to remove a syslog server host.

Syntax

[**no**] **logging host** *host-ip-address*

host-ip-address - The IP address of a syslog server.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Use this command more than once to build up a list of host IP addresses.
- The maximum number of host IP addresses allowed is five.

Example

```
SSE-G2252(config)#logging host 10.1.0.3
SSE-G2252(config)#
```

logging on

This command controls logging of error messages, sending debug or error messages to a logging process. The no form disables the logging process.

Syntax

[**no**] **logging on**

Default Setting

None

Command Mode

Global Configuration

Command Usage

The logging process controls error messages saved to switch memory or sent to remote syslog servers. You can use the **logging history** command to control the type of error messages that are stored in memory. You can use the **logging trap** command to control the type of error messages that are sent to specified syslog servers.

Example

```
SSE-G2252(config)#logging on
SSE-G2252(config)#
```

Related Commands

"logging history" on page 21-38

"logging trap" on page 21-41

"clear log" on page 21-42

logging trap

This command enables the logging of system messages to a remote server, or limits the syslog messages saved to a remote server based on severity. Use this command without a specified level to enable remote logging. Use the **no** form to disable remote logging.

Syntax

logging trap [**level** *level*]

no logging trap [**level**]

level - One of the syslog severity levels listed in the table on "logging history" on page 21-38. Messages sent include the selected level through level 0.

Default Setting

Disabled

Level 7

Command Mode

Global Configuration

Command Usage

- Using this command with a specified level enables remote logging and sets the minimum severity level to be saved.
- Using this command without a specified level also enables remote logging, but restores the minimum severity level to the default.

Example

```
SSE-G2252(config)#logging trap 4
SSE-G2252(config)#
```

clear log

This command clears messages from the log buffer.

Syntax

clear log [**flash** | **ram**]

flash - Event history stored in flash memory (i.e., permanent memory).

ram - Event history stored in temporary RAM (i.e., memory flushed on power reset).

Default Setting

Flash and RAM

Command Mode

Privileged Exec

Example

```
SSE-G2252#clear log
SSE-G2252#
```

Related Commands

"show log" on page 21-43

show log

This command displays the log messages stored in local memory.

Syntax

show log {**flash** | **ram**}

flash - Event history stored in flash memory (i.e., permanent memory).

ram - Event history stored in temporary RAM (i.e., memory flushed on power reset).

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- All log messages are retained in RAM and Flash after a warm restart (i.e., power is reset through the command interface).
- All log messages are retained in Flash and purged from RAM after a cold restart (i.e., power is turned off and then on through the power source).

Example

The following example shows the event message stored in RAM.

```
SSE-G2252#show log ram
[1] 00:01:30 2001-01-01
   "VLAN 1 link-up notification."
   level: 6, module: 5, function: 1, and event no.: 1
[0] 00:01:30 2001-01-01
   "Unit 1, Port  1 link-up notification."
   level: 6, module: 5, function: 1, and event no.: 1
SSE-G2252#
```

show logging

This command displays the configuration settings for logging messages to local switch memory, to an SMTP event handler, or to a remote syslog server.

Syntax

show logging {**flash** | **ram** | **sendmail** | **trap**}

flash - Displays settings for storing event messages in flash memory (i.e., permanent memory).

ram - Displays settings for storing event messages in temporary RAM (i.e., memory flushed on power reset).

sendmail - Displays settings for the SMTP event handler ("show logging sendmail" on page 21-50).

trap - Displays settings for the trap function.

Default Setting

None

Command Mode

Privileged Exec

Example

The following example shows that system logging is enabled, the message level for flash memory is "errors" (i.e., default level 3 - 0), and the message level for RAM is "debugging" (i.e., default level 7 - 0).

```
SSE-G2252#show logging flash
Syslog logging:           Enabled
History logging in FLASH: level errors
SSE-G2252#show logging ram
Syslog logging:           Enabled
History logging in RAM: level debugging
SSE-G2252#
```

Table 21-10. Show Logging Flash/RAM - Display Description

Field	Description
Syslog logging	Shows if system logging has been enabled via the logging on command.
History logging in FLASH	The message level(s) reported based on the logging history command.
History logging in RAM	The message level(s) reported based on the logging history command.

The following example displays settings for the trap function.

```
SSE-G2252#show logging trap
Syslog logging: Enable
REMOTELOG Status: disable
REMOTELOG Facility Type: Local use 7
REMOTELOG Level Type:        Debugging messages
REMOTELOG server IP Address: 1.2.3.4
REMOTELOG server IP Address: 0.0.0.0
REMOTELOG server IP Address: 0.0.0.0
REMOTELOG server IP Address: 0.0.0.0
REMOTELOG server IP Address: 0.0.0.0
SSE-G2252#
```

Table 21-11. Show Logging Trap - Display Description

Field	Description
Syslog logging	Shows if system logging has been enabled via the logging on command.
REMOTELOG status	Shows if remote logging has been enabled via the logging trap command.
REMOTELOG facility type	The facility type for remote logging of syslog messages as specified in the logging facility command.
REMOTELOG level type	The severity threshold for syslog messages sent to a remote server as specified in the logging trap command.
REMOTELOG server IP address	The address of syslog servers as specified in the logging host command.

Related Commands

"show logging sendmail" on page 21-50

21-7 SMTP Alerts

These commands configure SMTP event handling, and forwarding of alert messages to the specified SMTP servers and email recipients.

Table 21-12. Event Logging Commands

Command	Function	Mode
logging sendmail	Enables SMTP event handling	GC
logging sendmail host	SMTP servers to receive alert messages	GC
logging sendmail level	Severity threshold used to trigger alert messages	GC
logging Sendmail Destination-Email	Email recipients of alert messages	GC
logging Sendmail Source-Email	Email address used for "From" field of alert messages	GC
show logging sendmail	Displays SMTP event handler settings	NE, PE

logging sendmail

This command enables SMTP event handling. Use the **no** form to disable this function.

Syntax

[**no**] **logging sendmail**

Default Setting

Enabled

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#logging sendmail
SSE-G2252(config)#
```

logging sendmail host

This command specifies SMTP servers that will be sent alert messages. Use the **no** form to remove an SMTP server.

Syntax

[**no**] **logging sendmail host** *host* [**username** *username* **password** *password* **auth-basic**]

host - IP address or alias of an SMTP server that will be sent alert messages for event handling.

username - Name of SMTP server user. (Range: 1-8 characters)

password - Password of SMTP server user. (Range: 1-8 characters)

auth-basic - Indicates that Base 64 encoding is used.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- You can specify up to three SMTP servers for event handing. However, you must enter a separate command to specify each server.
- To send email alerts, the switch first opens a connection, sends all the email alerts waiting in the queue one by one, and finally closes the connection.
- To open a connection, the switch first selects the server that successfully sent mail during the last connection, or the first server configured by this command. If it fails to send mail, the switch selects the next server in the list and tries to send mail again. If it still fails, the system will repeat the process at a periodic interval. (A trap will be triggered if the switch cannot successfully open a connection.)

Example

```
SSE-G2252(config)#logging sendmail host 192.168.1.19
SSE-G2252(config)#
```

logging sendmail level

This command sets the severity threshold used to trigger alert messages. Use the **no** form to restore the default setting.

Syntax

logging sendmail level *level*

no logging sendmail level

level - One of the system message levels ("logging history" on page 21-38). Messages sent include the selected level down to level 0. (Range: 0-7; Default: 7)

Default Setting

Level 7

Command Mode

Global Configuration

Command Usage

The specified level indicates an event threshold. All events at this level or higher will be sent to the configured email recipients. (For example, using Level 7 will report all events from level 7 to level 0.)

Example

This example will send email alerts for system errors from level 3 through 0.

```
SSE-G2252(config)#logging sendmail level 3
SSE-G2252(config)#
```

logging Sendmail Destination-Email

This command specifies the email recipients of alert messages. Use the **no** form to remove a recipient.

Syntax

[**no**] **logging sendmail destination-email** *email-address*

email-address -The source email address used in alert messages. (Range: 1-41 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

You can specify up to five recipients for alert messages. However, you must enter a separate command to specify each recipient.

Example

```
SSE-G2252(config)#logging sendmail destination-email ted@this-company.com
SSE-G2252(config)#
```

logging Sendmail Source-Email

This command sets the email address used for the "From" field in alert messages. Use the ***no*** form to restore the default value.

Syntax

logging sendmail source-email *email-address*

no logging sendmail source-email

email-address - The source email address used in alert messages. (Range: 1-41 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

You may use an symbolic email address that identifies the switch, or the address of an administrator responsible for the switch.

Example

```
SSE-G2252(config)#logging sendmail source-email bill@this-company.com
SSE-G2252(config)#
```

show logging sendmail

This command displays the settings for the SMTP event handler.

Command Mode

Normal Exec, Privileged Exec

Example

```
SSE-G2252#show logging sendmail
SMTP servers
-------------------------------------------
192.168.1.19

SMTP Minimum Severity Level: 7

SMTP destination email addresses
-------------------------------------------
ted@this-company.com

SMTP Source Email Address: bill@this-company.com

SMTP Status: Enabled
SSE-G2252#
```

21-8 Time

The system clock can be dynamically set by polling a set of specified time servers (NTP or SNTP). Maintaining an accurate time on the switch enables the system log to record meaningful dates and times for event entries. If the clock is not set, the switch will only record the time from the factory default set at the last bootup.

Table 21-13. Time Commands

Command	Function	Mode
SNTP Commands		
sntp client	Accepts time from specified time servers	GC
sntp poll	Sets the interval at which the client polls for time	GC
sntp server	Specifies one or more time servers	GC
show sntp	Shows current SNTP configuration settings	NE, PE
Manual Configuration Commands		
clock timezone	Sets the time zone for the switch's internal clock	GC
clock timezone-predefined	Sets the time zone for the switch's internal clock using predefined time zone configurations	GC
calendar set	Sets the system date and time	PE
show calendar	Displays the current date and time setting	NE, PE

sntp client

This command enables SNTP client requests for time synchronization from NTP or SNTP time servers specified with the sntp server command. Use the **no** form to disable SNTP client requests.

Syntax

[**no**] **sntp client**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- The time acquired from time servers is used to record accurate dates and times for log events. Without SNTP, the switch only records the time starting from the factory default set at the last bootup (i.e., 00:00:00, Jan. 1, 2001).
- This command enables client time requests to time servers specified via the sntp server command. It issues time synchronization requests based on the interval set via the sntp poll command.

Example

```
SSE-G2252(config)#sntp server 10.1.0.19
SSE-G2252(config)#sntp poll 60
SSE-G2252(config)#sntp client
SSE-G2252(config)#end
SSE-G2252#show sntp
Current Time:  Dec 23 02:52:44 2002
Poll Interval: 60
Current Mode: unicast
SNTP Status : Enabled
SNTP Server 137.92.140.80 0.0.0.0 0.0.0.0
Current Server: 137.92.140.80
SSE-G2252#
```

Related Commands

"sntp server" on page 21-54

"sntp poll" on page 21-53

"show sntp" on page 21-55

sntp poll

This command sets the interval between sending time requests when the switch is set to SNTP client mode. Use the **no** form to restore to the default.

Syntax

sntp poll *seconds*

no sntp poll

seconds - Interval between time requests. (Range: 16-16384 seconds)

Default Setting

16 seconds

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#sntp poll 60
SSE-G2252#
```

Related Commands

"sntp client" on page 21-52

sntp server

This command sets the IP address of the servers to which SNTP time requests are issued. Use the this command with no arguments to clear all time servers from the current list. Use the **no** form to clear all time servers from the current list, or to clear a specific server.

Syntax

sntp server [*ip1* [*ip2* [*ip3*]]]

no sntp server [*ip1* [*ip2* [*ip3*]]]

ip - IP address of an time server (NTP or SNTP). (Range: 1 - 3 addresses)

Default Setting

None

Command Mode

Global Configuration

Command Usage

This command specifies time servers from which the switch will poll for time updates when set to SNTP client mode. The client will poll the time servers in the order specified until a response is received. It issues time synchronization requests based on the interval set via the sntp poll command.

Example

```
SSE-G2252(config)#sntp server 10.1.0.19
SSE-G2252#
```

Related Commands

"sntp client" on page 21-52

"sntp poll" on page 21-53

"show sntp" on page 21-55

show sntp

This command displays the current time and configuration settings for the SNTP client, and indicates whether or not the local time has been properly updated.

Command Mode

Normal Exec, Privileged Exec

Command Usage

This command displays the current time, the poll interval used for sending time synchronization requests, and the current SNTP mode (i.e., unicast).

Example

```
SSE-G2252#show sntp
Current Time   : Nov  5 18:51:22 2006
Poll Interval  : 16 seconds
Current Mode   : Unicast
SNTP Status    : Enabled
SNTP Server    : 137.92.140.80 0.0.0.0 0.0.0.0
Current Server : 137.92.140.80
SSE-G2252#
```

clock timezone

This command sets the time zone for the switch's internal clock.

Syntax

clock timezone *name* **hour** *hours* **minute** *minutes* {**before-utc** | **after-utc**}

name - Name of timezone, usually an acronym. (Range: 1-30 characters)

hours - Number of hours before/after UTC. (Range: 0-12 hours before UTC, 0-13 hours after UTC)

minutes - Number of minutes before/after UTC. (Range: 0-59 minutes)

before-utc - Sets the local time zone before (east) of UTC.

after-utc - Sets the local time zone after (west) of UTC.

Default Setting

None

Command Mode

Global Configuration

Command Usage

This command sets the local time zone relative to the Coordinated Universal Time (UTC, formerly Greenwich Mean Time or GMT), based on the earth's prime meridian, zero degrees longitude. To display a time corresponding to your local time, you must indicate the number of hours and minutes your time zone is east (before) or west (after) of UTC.

Example

```
SSE-G2252(config)#clock timezone Japan hours 8 minute 0 after-UTC
SSE-G2252(config)#
```

Related Commands

"show sntp" on page 21-55

clock timezone-predefined

This command uses predefined time zone configurations to set the time zone for the switch's internal clock. Use the **no** form to restore the default.

Syntax

clock timezone-predefined *offset-city*

no clock timezone-predefined

offset - Select the offset from GMT. (Range: GMT-0100 - GMT-1200; GMT-Greenwich-Mean-Time; GMT+0100 - GMT+1300)

city - Select the city associated with the chosen GMT offset. After the offset has been entered, use the tab-complete function to display the available city options.

Default Setting

GMT-Greenwich-Mean-Time-Dublin,Edinburgh,Lisbon,London

Command Mode

Global Configuration

Command Usage

This command sets the local time zone relative to the Coordinated Universal Time (UTC, formerly Greenwich Mean Time or GMT), based on the earth's prime meridian, zero degrees longitude. To display a time corresponding to your local time, you must indicate the number of hours and minutes your time zone is east (before) or west (after) of UTC.

Example

```
SSE-G2252(config)#clock timezone-predefined GMT-0930-Taiohae
SSE-G2252(config)#
```

Related Commands

"show sntp" on page 21-55

calendar set

This command sets the system clock. It may be used if there is no time server on your network, or if you have not configured the switch to receive signals from a time server.

Syntax

calendar set *hour min sec* {*day month year* | *month day year*}

hour - Hour in 24-hour format. (Range: 0 - 23)

min - Minute. (Range: 0 - 59)

sec - Second. (Range: 0 - 59)

day - Day of month. (Range: 1 - 31)

month - **january** | **february** | **march** | **april** | **may** | **june** | **july** | **august** | **september** | **october** | **november** | **december**

year - Year (4-digit). (Range: 2001 - 2100)

Default Setting

None

Command Mode

Privileged Exec

Command Usage

Note that when SNTP is enabled, the system clock cannot be manually configured.

Example

This example shows how to set the system clock to 15:12:34, February 1st, 2002.

```
SSE-G2252#calendar set 15:12:34 1 February 2002
SSE-G2252#
```

show calendar

This command displays the system clock.

Default Setting

None

Command Mode

Normal Exec, Privileged Exec

Example

```
SSE-G2252#show calendar
 15:12:34 February 1 2002
SSE-G2252#
```

21-9 Time Range

This section describes the commands used to sets a time range for use by other functions, such as Access Control Lists.

Table 21-14. Time Range Commands

Command	Function	Mode
time-range	Specifies the name of a time range, and enters time range configuration mode	GC
absolute	Sets the time range for the execution of a command	TR
periodic	Sets the time range for the periodic execution of a command	TR
show time-range	Shows configured time ranges.	PE

time-range

This command specifies the name of a time range, and enters time range configuration mode. Use the **no** form to remove a previously specified time range.

Syntax

[**no**] **time-range** *name*

name - Name of the time range. (Range: 1-16 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

This command sets a time range for use by other functions, such as Access Control Lists.

Example

```
SSE-G2252(config)#time-range r&d
SSE-G2252(config-time-range)#
```

absolute

This command sets the time range for the execution of a command. Use the **no** form to remove a previously specified time.

Syntax

absolute start *hour minute day month year* [**end** *hour minutes day month year*]

absolute end *hour minutes day month year*

no absolute

hour - Hour in 24-hour format. (Range: 0-23)

minute - Minute. (Range: 0-59)

day - Day of month. (Range: 1-31)

month - **january** | **february** | **march** | **april** | **may** | **june** | **july** | **august** | **september** | **october** | **november** | **december**

year - Year (4-digit). (Range: 2009-2109)

Default Setting

None

Command Mode

Time Range Configuration

Command Usage

- If a time range is already configured, you must use the **no** form of this command to remove the current entry prior to configuring a new time range.
- If both an absolute rule and one or more periodic rules are configured for the same time range (i.e., named entry), that entry will only take effect if the current time is within the absolute time range and one of the periodic time ranges.

Example

This example configures the time for the single occurrence of an event.

```
SSE-G2252(config)#time-range r&d
SSE-G2252(config-time-range)#absolute start 1 1 1 april 2009 end 2 1 1
april 2009
SSE-G2252(config-time-range)#
```

periodic

This command sets the time range for the periodic execution of a command. Use the **no** form to remove a previously specified time range.

Syntax

[**no**] **periodic** {**daily** | **friday** | **monday** | **saturday** | **sunday** | **thursday** | **tuesday** | **wednesday** | **weekdays** | **weekend**} *hour minute* to {**daily** | **friday** | **monday | saturday** | **sunday** | **thursday** | **tuesday** | **wednesday** | **weekdays** | **weekend** | *hour minute*}

daily - Daily

friday - Friday

monday - Monday

saturday - Saturday

sunday - Sunday

thursday - Thursday

tuesday - Tuesday

wednesday - Wednesday

weekdays - Weekdays

weekend - Weekends

hour - Hour in 24-hour format. (Range: 0-23)

minute - Minute. (Range: 0-59)

Default Setting

None

Command Mode

Time Range Configuration

Command Usage

- If a time range is already configured, you must use the **no** form of this command to remove the current entry prior to configuring a new time range.
- If both an absolute rule and one or more periodic rules are configured for the same time range (i.e., named entry), that entry will only take effect if the current time is within the absolute time range and one of the periodic time ranges.

Example

This example configures a time range for the periodic occurrence of an event.

```
SSE-G2252(config)#time-range sales
SSE-G2252(config-time-range)#periodic daily 1 1 to 2 1
SSE-G2252(config-time-range)#
```

show time-range

This command shows configured time ranges.

Syntax

show time-range [*name*]

name - Name of the time range. (Range: 1-30 characters)

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#showtime-range r&d
 Time-range r&d:
   absolute start 01:01 01 April 2009
   periodic    Daily 01:01 to    Daily 02:01
   periodic    Daily 02:01 to    Daily 03:01
SSE-G2252#
```

21-10Switch Clustering

Switch Clustering is a method of grouping switches together to enable centralized management through a single unit. Switches that support clustering can be grouped together regardless of physical location or switch type, as long as they are connected to the same local network.

Table 21-15. Switch Cluster Commands

Command	Function	Mode
cluster	Configures clustering on the switch	GC
cluster commander	Configures the switch as a cluster Commander	GC
cluster ip-pool	Sets the cluster IP address pool for Members	GC
cluster member	Sets Candidate switches as cluster members	GC
rcommand	Provides configuration access to Member switches	GC
show cluster	Displays the switch clustering status	PE
show cluster members	Displays current cluster Members	PE
show cluster candidates	Displays current cluster Candidates in the network	PE

Using Switch Clustering

- A switch cluster has a primary unit called the "Commander" which is used to manage all other "Member" switches in the cluster. The management station can use either Telnet or the web interface to communicate directly with the Commander through its IP address, and then use the Commander to manage the Member switches through the cluster's "internal" IP addresses.
- Clustered switches must be in the same Ethernet broadcast domain. In other words, clustering only functions for switches which can pass information between the Commander and potential Candidates or active Members through VLAN 4093.
- Once a switch has been configured to be a cluster Commander, it automatically discovers other cluster-enabled switches in the network. These "Candidate" switches only become cluster Members when manually selected by the administrator through the management station.
- The cluster VLAN 4093 is not configured by default. Before using clustering, take the following actions to set up this VLAN:

1. Create VLAN 4093 (see Section 35-2: "Editing VLAN Groups" on page 35-8).
2. Add the participating ports to this VLAN (see Section 35-3: "Configuring VLAN Interfaces" on page 35-10), and set them to hybrid mode, tagged members, PVID = 1, and acceptable frame type = all.

NOTE: Cluster Member switches can be managed either through a Telnet connection to the Commander, or through a web management connection to the Commander. When using a console connection, from the Commander CLI prompt, use the rcommand to connect to the Member switch.

cluster

This command enables clustering on the switch. Use the **no** form to disable clustering.

Syntax

[**no**] **cluster**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- To create a switch cluster, first be sure that clustering is enabled on the switch (the default is enabled), then set the switch as a Cluster Commander. Set a Cluster IP Pool that does not conflict with any other IP subnets in the network. Cluster IP addresses are assigned to switches when they become Members and are used for communication between Member switches and the Commander.
- Switch clusters are limited to the same Ethernet broadcast domain.
- There can be up to 100 candidates and 36 member switches in one cluster.
- A switch can only be a Member of one cluster.
- Configured switch clusters are maintained across power resets and network changes.

Example

```
SSE-G2252(config)#cluster
SSE-G2252(config)#
```

cluster commander

This command enables the switch as a cluster Commander. Use the **no** form to disable the switch as cluster Commander.

Syntax

[**no**] **cluster commander**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- Once a switch has been configured to be a cluster Commander, it automatically discovers other cluster-enabled switches in the network. These "Candidate" switches only become cluster Members when manually selected by the administrator through the management station.
- Cluster Member switches can be managed through a Telnet connection to the Commander. From the Commander CLI prompt, use the rcommand command to connect to the Member switch.

Example

```
SSE-G2252(config)#cluster commander
SSE-G2252(config)#
```

cluster ip-pool

This command sets the cluster IP address pool. Use the **no** form to reset to the default address.

Syntax

cluster ip-pool *ip-address*

no cluster ip-pool

ip-address - The base IP address for IP addresses assigned to cluster Members. The IP address must start 10.x.x.x.

Default Setting

10.254.254.1

Command Mode

Global Configuration

Command Usage

- An “internal” IP address pool is used to assign IP addresses to Member switches in the cluster. Internal cluster IP addresses are in the form 10.*x.x.member-ID*. Only the base IP address of the pool needs to be set since Member IDs can only be between 1 and 36.
- Set a Cluster IP Pool that does not conflict with addresses in the network IP subnet. Cluster IP addresses are assigned to switches when they become Members and are used for communication between Member switches and the Commander.
- You cannot change the cluster IP pool when the switch is currently in Commander mode. Commander mode must first be disabled.

Example

```
SSE-G2252(config)#cluster ip-pool 10.2.3.4
SSE-G2252(config)#
```

cluster member

This command configures a Candidate switch as a cluster Member. Use the **no** form to remove a Member switch from the cluster.

Syntax

cluster member mac-address *mac-address* **id** *member-id*

no cluster member id *member-id*

mac-address - The MAC address of the Candidate switch.

member-id - The ID number to assign to the Member switch. (Range: 1-36)

Default Setting

No Members

Command Mode

Global Configuration

Command Usage

- The maximum number of cluster Members is 36.
- The maximum number of cluster Candidates is 100.

Example

```
SSE-G2252(config)#cluster member mac-address 00-12-34-56-78-9a id 5
SSE-G2252(config)#
```

rcommand

This command provides access to a cluster Member CLI for configuration.

Syntax

rcommand id *member-id*

member-id - The ID number of the Member switch.
(Range: 1-36)

Command Mode

Privileged Exec

Command Usage

- This command only operates through a Telnet connection to the Commander switch. Managing cluster Members using the local console CLI on the Commander is not supported.
- There is no need to enter the username and password for access to the Member switch CLI.

Example

```
SSE-G2252#rcommand id 1

      CLI session with the SSE-G2252P is opened.
      To end the CLI session, enter [Exit].

Vty-0#
```

show cluster

This command shows the switch clustering configuration.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show cluster
Role                 : commander
Interval Heartbeat   : 30
Heartbeat Loss Count : 3 seconds
Number of Members    : 1
Number of Candidates : 2
SSE-G2252#
```

show cluster members

This command shows the current switch cluster members.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show cluster members
Cluster Members:
ID          : 1
Role        : Active member
IP Address  : 10.254.254.2
MAC Address : 00-E0-0C-00-00-FE
Description : SSE-G2252P Managed GE POE Switch
SSE-G2252#
```

show cluster candidates

This command shows the discovered Candidate switches in the network.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show cluster candidates
Cluster Candidates:
Role            MAC Address       Description
--------------- ----------------- ---------------------------------------
Active member   00-E0-0C-00-00-FE SSE-G2252P Managed GE POE Switch
CANDIDATE       00-12-CF-0B-47-A0 SSE-G2252P Managed GE POE Switch
SSE-G2252#
```

Chapter 22
SNMP Commands

Controls access to this switch from management stations using the Simple Network Management Protocol (SNMP), as well as the error types sent to trap managers.

SNMP Version 3 also provides security features that cover message integrity, authentication, and encryption; as well as controlling user access to specific areas of the MIB tree. To use SNMPv3, first set an SNMP engine ID (or accept the default), specify read and write access views for the MIB tree, configure SNMP user groups with the required security model (i.e., SNMP v1, v2c or v3) and security level (i.e., authentication and privacy), and then assign SNMP users to these groups, along with their specific authentication and privacy passwords.

Table 22-1. SNMP Commands

Command	Function	Mode
General SNMP Commands		
snmp-server	Enables the SNMP agent	GC
snmp-server community	Sets up the community access string to permit access to SNMP commands	GC
snmp-server contact	Sets the system contact string	GC
snmp-server location	Sets the system location string	GC
show snmp	Displays the status of SNMP communications	NE, PE
SNMP Target Host Commands		
snmp-server enable traps	Enables the device to send SNMP traps (i.e., SNMP notifications)	GC
snmp-server host	Specifies the recipient of an SNMP notification operation	GC
SNMPv3 Engine Commands		
snmp-server engine-id	Sets the SNMP engine ID	GC
snmp-server group	Adds an SNMP group, mapping users to views	GC
snmp-server user	Adds a user to an SNMP group	GC
snmp-server view	Adds an SNMP view	GC
show snmp engine-id	Shows the SNMP engine ID	PE
show snmp group	Shows the SNMP groups	PE
show snmp user	Shows the SNMP users	PE
show snmp view	Shows the SNMP views	PE
Notification Log Commands		
nlm	Enables the specified notification log	GC
snmp-server notify-filter	Creates a notification log and specifies the target host	GC
show nlm oper-status	Shows operation status of configured notification logs	PE

Table 22-1. SNMP Commands (Continued)

Command	Function	Mode
show snmp notify-filter	Displays the configured notification logs	PE
ATC Trap Commands		
snmp-server enable port-traps atc broadcast-alarm-clear	Sends a trap when broadcast traffic falls beneath the lower threshold after a storm control response has been triggered	IC (Port)
snmp-server enable port-traps atc broadcast-alarm-fire	Sends a trap when broadcast traffic exceeds the upper threshold for automatic storm control	IC (Port)
snmp-server enable port-traps atc broadcast-control-apply	Sends a trap when broadcast traffic exceeds the upper threshold for automatic storm control and the apply timer expires	IC (Port)
snmp-server enable port-traps atc broadcast-control-release	Sends a trap when broadcast traffic falls beneath the lower threshold after a storm control response has been triggered and the release timer expires	IC (Port)
snmp-server enable port-traps atc multicast-alarm-clear	Sends a trap when multicast traffic falls beneath the lower threshold after a storm control response has been triggered	IC (Port)
snmp-server enable port-traps atc multicast-alarm-fire	Sends a trap when multicast traffic exceeds the upper threshold for automatic storm control	IC (Port)
snmp-server enable port-traps atc broadcast-control-apply	Sends a trap when multicast traffic exceeds the upper threshold for automatic storm control and the apply timer expires	IC (Port)
snmp-server enable port-traps atc multicast-control-release	Sends a trap when multicast traffic falls beneath the lower threshold after a storm control response has been triggered and the release timer expires	IC (Port)

snmp-server

This command enables the SNMPv3 engine and services for all management clients (i.e., versions 1, 2c, 3). Use the **no** form to disable the server.

Syntax

[**no**] **snmp-server**

Default Setting

Enabled

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#snmp-server
SSE-G2252(config)#
```

snmp-server community

This command defines community access strings used to authorize management access by clients using SNMP v1 or v2c. Use the **no** form to remove the specified community string.

Syntax

snmp-server community *string* [**ro** | **rw**]

no snmp-server community *string*

string - Community string that acts like a password and permits access to the SNMP protocol. (Maximum length: 32 characters, case sensitive; Maximum number of strings: 5)

ro - Specifies read-only access. Authorized management stations are only able to retrieve MIB objects.

rw - Specifies read/write access. Authorized management stations are able to both retrieve and modify MIB objects.

Default Setting

- Public - Read-only access. Authorized management stations are only able to retrieve MIB objects.
- Private - Read/write access. Authorized management stations are able to both retrieve and modify MIB objects.

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#snmp-server community alpha rw
SSE-G2252(config)#
```

snmp-server contact

This command sets the system contact string. Use the **no** form to remove the system contact information.

Syntax

snmp-server contact *string*

no snmp-server contact

string - String that describes the system contact information. (Maximum length: 255 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#snmp-server contact Paul
SSE-G2252(config)#
```

Related Commands

"snmp-server location" on page 22-5

snmp-server location

This command sets the system location string. Use the **no** form to remove the location string.

Syntax

snmp-server location *text*

no snmp-server location

text - String that describes the system location. (Maximum length: 255 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#snmp-server location WC-19
SSE-G2252(config)#
```

Related Commands

"snmp-server contact" on page 22-4

show snmp

This command can be used to check the status of SNMP communications.

Default Setting

None

Command Mode

Normal Exec, Privileged Exec

Command Usage

This command provides information on the community access strings, counter information for SNMP input and output protocol data units, and whether or not SNMP logging has been enabled with the **snmp-server enable traps** command.

Example

```
SSE-G2252#show snmp

SNMP Agent : Enabled

SNMP Traps :
 Authentication : Enabled
 Link-up-down   : Enabled

SNMP Communities :
   1. public, and the access level is read-only
   2. private, and the access level is read/write

0 SNMP packets input
    0 Bad SNMP version errors
    0 Unknown community name
    0 Illegal operation for community name supplied
    0 Encoding errors
    0 Number of requested variables
    0 Number of altered variables
    0 Get-request PDUs
    0 Get-next PDUs
    0 Set-request PDUs
0 SNMP packets output
    0 Too big errors
    0 No such name errors
    0 Bad values errors
    0 General errors
    0 Response PDUs
    0 Trap PDUs

SNMP Logging: Disabled
SSE-G2252#
```

snmp-server enable traps

This command enables this device to send Simple Network Management Protocol traps or informs (i.e., SNMP notifications). Use the **no** form to disable SNMP notifications.

Syntax

[**no**] **snmp-server enable traps [authentication** | **link-up-down**]

authentication - Keyword to issue authentication failure notifications.

link-up-down - Keyword to issue link-up or link-down notifications.

Default Setting

Issue authentication and link-up-down traps.

Command Mode

Global Configuration

Command Usage

- If you do not enter an **snmp-server enable traps** command, no notifications controlled by this command are sent. In order to configure this device to send SNMP notifications, you must enter at least one **snmp-server enable traps** command. If you enter the command with no keywords, both authentication and link-up-down notifications are enabled. If you enter the command with a keyword, only the notification type related to that keyword is enabled.
- The **snmp-server enable traps** command is used in conjunction with the snmp-server host command. Use the snmp-server host command to specify which host or hosts receive SNMP notifications. In order to send notifications, you must configure at least one snmp-server host command.
- The authentication, link-up, and link-down traps are legacy notifications, and therefore when used for SNMP Version 3 hosts, they must be enabled in conjunction with the corresponding entries in the Notify View assigned by the snmp-server group command.

Example

```
SSE-G2252(config)#snmp-server enable traps link-up-down
SSE-G2252(config)#
```

Related Commands

"snmp-server host" on page 22-8

snmp-server host

This command specifies the recipient of a Simple Network Management Protocol notification operation. Use the **no** form to remove the specified host.

Syntax

snmp-server host *host-addr community-string* [**inform** [**retry** *retries* | **timeout** *seconds* | **version** {**1** | **2c** | **3** {**auth** | **noauth** | **priv**}]]
| **version** {**1** | **2c** | **3** {**auth** | **noauth** | **priv**} [**udp-port** *port*]}

no snmp-server host *host-addr*

host-addr - Internet address of the host (the targeted recipient). (Maximum host addresses: 5 trap destination IP address entries)

inform - Notifications are sent as inform messages. Note that this option is only available for version 2c and 3 hosts. (Default: traps are used)

retries - The maximum number of times to resend an inform message if the recipient does not acknowledge receipt. (Range: 0-255; Default: 3)

seconds - The number of seconds to wait for an acknowledgment before resending an inform message. (Range: 0-2147483647 centiseconds; Default: 1500 centiseconds)

community-string - Password-like community string sent with the notification operation to SNMP V1 and V2c hosts. Although you can set this string using the **snmp-server host** command by itself, we recommend defining it with the snmp-server community command prior to using the **snmp-server host** command. (Maximum length: 32 characters)

version - Specifies whether to send notifications as SNMP Version 1, 2c or 3 traps. (Range: 1, 2c, 3; Default: 1)

auth | noauth | priv - This group uses SNMPv3 with authentication, no authentication, or with authentication and privacy. See Section 15-4: "Simple Network Management Protocol" on page 15-29 for further information about these authentication and encryption options.

port - Host UDP port to use. (Range: 1-65535; Default: 162)

Default Setting

Host Address: None

Notification Type: Traps

SNMP Version: 1

UDP Port: 162

Command Mode

Global Configuration

Command Usage

- If you do not enter an **snmp-server host** command, no notifications are sent. In order to configure the switch to send SNMP notifications, you must enter at least one **snmp-server host** command. In order to enable multiple hosts, you must issue a separate **snmp-server host** command for each host.
- The **snmp-server host** command is used in conjunction with the snmp-server enable traps command. Use the snmp-server enable traps command to enable the sending of traps or informs and to specify which SNMP notifications are sent globally. For a host to receive notifications, at least one snmp-server enable traps command and the **snmp-server host** command for that host must be enabled.
- Some notification types cannot be controlled with the snmp-server enable traps command. For example, some notification types are always enabled.
- Notifications are issued by the switch as trap messages by default. The recipient of a trap message does not send a response to the switch. Traps are therefore not as reliable as inform messages, which include a request for acknowledgement of receipt. Informs can be used to ensure that critical information is received by the host. However, note that informs consume more system resources because they must be kept in memory until a response is received. Informs also add to network traffic. You should consider these effects when deciding whether to issue notifications as traps or informs.

To send an inform to a SNMPv2c host, complete these steps:

1. Enable the SNMP agent ("snmp-server" on page 22-2).
2. Create a view with the required notification messages ("snmp-server view" on page 22-15).
3. Create a group that includes the required notify view ("snmp-server group" on page 22-12).
4. Allow the switch to send SNMP traps; i.e., notifications ("snmp-server enable traps" on page 22-7).
5. Specify the target host that will receive inform messages with the **snmp-server host** command as described in this section.

To send an inform to a SNMPv3 host, complete these steps:

1. Enable the SNMP agent ("snmp-server" on page 22-2).
2. Create a local SNMPv3 user to use in the message exchange process ("snmp-server user" on page 22-13).
3. Create a view with the required notification messages ("snmp-server view" on page 22-15).
4. Create a group that includes the required notify view ("snmp-server group" on page 22-12).
5. Allow the switch to send SNMP traps; i.e., notifications ("snmp-server enable traps" on page 22-7).

6. Specify the target host that will receive inform messages with the **snmp-server host** command as described in this section.

- The switch can send SNMP Version 1, 2c or 3 notifications to a host IP address, depending on the SNMP version that the management station supports. If the **snmp-server host** command does not specify the SNMP version, the default is to send SNMP version 1 notifications.
- If you specify an SNMP Version 3 host, then the community string is interpreted as an SNMP user name. The user name must first be defined with the snmp-server user command. Otherwise, an SNMPv3 group will be automatically created by the **snmp-server host** command using the name of the specified community string, and default settings for the read, write, and notify view.

Example

```
SSE-G2252(config)#snmp-server host 10.1.19.23 batman
SSE-G2252(config)#
```

Related Commands

"snmp-server enable traps" on page 22-7

snmp-server engine-id

This command configures an identification string for the SNMPv3 engine. Use the **no** form to restore the default.

Syntax

snmp-server engine-id {**local** | **remote** {*ip-address*}} *engineid-string*

no snmp-server engine-id {**local** | **remote** {*ip-address*}}

local - Specifies the SNMP engine on this switch.

remote - Specifies an SNMP engine on a remote device.

ip-address - The Internet address of the remote device.

engineid-string - String identifying the engine ID. (Range: 1-26 hexadecimal characters)

Default Setting

A unique engine ID is automatically generated by the switch based on its MAC address.

Command Mode

Global Configuration

Command Usage

- An SNMP engine is an independent SNMP agent that resides either on this switch or on a remote device. This engine protects against message replay, delay, and redirection. The engine ID is also used in combination with user passwords to generate the security keys for authenticating and encrypting SNMPv3 packets.
- A remote engine ID is required when using SNMPv3 informs. (See the snmp-server host command.) The remote engine ID is used to compute the security digest for authentication and encryption of packets passed between the switch and a user on the remote host. SNMP passwords are localized using the engine ID of the authoritative agent. For informs, the authoritative SNMP agent is the remote agent. You therefore need to configure the remote agent's SNMP engine ID before you can send proxy requests or informs to it.
- Trailing zeroes need not be entered to uniquely specify a engine ID. In other words, the value "0123456789" is equivalent to "0123456789" followed by 16 zeroes for a local engine ID.
- A local engine ID is automatically generated that is unique to the switch. This is referred to as the default engine ID. If the local engine ID is deleted or changed, all SNMP users will be cleared. You will need to reconfigure all existing users ("snmp-server user" on page 22-13).

Example

```
SSE-G2252(config)#snmp-server engine-id local 1234567890
SSE-G2252(config)#snmp-server engineID remote 9876543210 192.168.1.19
SSE-G2252(config)#
```

Related Commands

"snmp-server host" on page 22-8

snmp-server group

This command adds an SNMP group, mapping SNMP users to SNMP views. Use the **no** form to remove an SNMP group.

Syntax

snmp-server group *groupname*
{**v1** | **v2c** | **v3** {**auth** | **noauth** | **priv**}}
[**read** *readview*] [**write** *writeview*] [**notify** *notifyview*]

no snmp-server group *groupname*

groupname - Name of an SNMP group. (Range: 1-32 characters)

v1 | **v2c** | **v3** - Use SNMP version 1, 2c or 3.

auth | **noauth** | **priv** - This group uses SNMPv3 with authentication, no authentication, or with authentication and privacy. See Section 15-4: "Simple Network Management Protocol" on page 15-29 for further information about these authentication and encryption options.

readview - Defines the view for read access. (1-32 characters)

writeview - Defines the view for write access. (1-32 characters)

notifyview - Defines the view for notifications. (1-32 characters)

Default Setting

Default groups: public[1] (read only), private[2] (read/write)

readview - Every object belonging to the Internet OID space (1).

writeview - Nothing is defined.

notifyview - Nothing is defined.

Command Mode

Global Configuration

Command Usage

- A group sets the access policy for the assigned users.
- When authentication is selected, the MD5 or SHA algorithm is used as specified in the snmp-server user command.
- When privacy is selected, the DES 56-bit algorithm is used for data encryption.

1. No view is defined.
2. Maps to the defaultview.

- For additional information on the notification messages supported by this switch, see Table 15-8: "Supported Notification Messages" on page 15-39. Also, note that the authentication, link-up and link-down messages are legacy traps and must therefore be enabled in conjunction with the snmp-server enable traps command.

Example

```
SSE-G2252(config)#snmp-server group r&d v3 auth write daily
SSE-G2252(config)#
```

snmp-server user

This command adds a user to an SNMP group, restricting the user to a specific SNMP Read, Write, or Notify View. Use the **no** form to remove a user from an SNMP group.

Syntax

snmp-server user *username groupname* [**remote** *ip-address*]
{**v1** | **v2c** | **v3** [**encrypted**] [**auth** {**md5** | **sha**} *auth-password* [**priv des56** *priv-password*]]

no snmp-server user *username* {**v1** | **v2c** | **v3** | **remote**}

username - Name of user connecting to the SNMP agent. (Range: 1-32 characters)

groupname - Name of an SNMP group to which the user is assigned. (Range: 1-32 characters)

remote - Specifies an SNMP engine on a remote device.

ip-address - The Internet address of the remote device.

v1 | **v2c** | **v3** - Use SNMP version 1, 2c or 3.

encrypted - Accepts the password as encrypted input.

auth - Uses SNMPv3 with authentication.

md5 | **sha** - Uses MD5 or SHA authentication.

auth-password - Authentication password. Enter as plain text if the **encrypted** option is not used. Otherwise, enter an encrypted password. (A minimum of eight characters is required.)

priv des56 - Uses SNMPv3 with privacy with DES56 encryption.

priv-password - Privacy password. Enter as plain text if the **encrypted** option is not used. Otherwise, enter an encrypted password.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Local users (i.e., the command does not specify a remote engine identifier) must be configured to authorize management access for SNMPv3 clients, or to identify the source of SNMPv3 trap messages sent from the local switch.
- Remote users (i.e., the command specifies a remote engine identifier) must be configured to identify the source of SNMPv3 inform messages sent from the local switch.
- The SNMP engine ID is used to compute the authentication/privacy digests from the password. You should therefore configure the engine ID with the snmp-server engine-id command before using this configuration command.
- Before you configure a remote user, use the snmp-server engine-id command to specify the engine ID for the remote device where the user resides. Then use the **snmp-server user** command to specify the user and the IP address for the remote device where the user resides. The remote agent's SNMP engine ID is used to compute authentication/privacy digests from the user's password. If the remote engine ID is not first configured, the **snmp-server user** command specifying a remote user will fail.
- SNMP passwords are localized using the engine ID of the authoritative agent. For informs, the authoritative SNMP agent is the remote agent. You therefore need to configure the remote agent's SNMP engine ID before you can send proxy requests or informs to it.

Example

```
SSE-G2252(config)#snmp-server user steve group r&d v3 auth md5 greenpeace
priv des56 einstien
SSE-G2252(config)#snmp-server user mark group r&d remote 192.168.1.19 v3
auth md5 greenpeace priv des56 einstien
SSE-G2252(config)#
```

snmp-server view

This command adds an SNMP view which controls user access to the MIB. Use the **no** form to remove an SNMP view.

Syntax

snmp-server view *view-name oid-tree* {**included** | **excluded**}

no snmp-server view *view-name*

view-name - Name of an SNMP view. (Range: 1-32 characters)

oid-tree - Object identifier of a branch within the MIB tree. Wild cards can be used to mask a specific portion of the OID string. (Refer to the examples.)

included - Defines an included view.

excluded - Defines an excluded view.

Default Setting

defaultview (includes access to the entire MIB tree)

Command Mode

Global Configuration

Command Usage

- Views are used in the snmp-server group command to restrict user access to specified portions of the MIB tree.
- The predefined view “defaultview” includes access to the entire MIB tree.

Examples

This view includes MIB-2.

```
SSE-G2252(config)#snmp-server view mib-2 1.3.6.1.2.1 included
SSE-G2252(config)#
```

This view includes the MIB-2 interfaces table, ifDescr. The wild card is used to select all the index values in this table.

```
SSE-G2252(config)#snmp-server view ifEntry.2 1.3.6.1.2.1.2.2.1.*.2
included
SSE-G2252(config)#
```

This view includes the MIB-2 interfaces table, and the mask selects all index entries.

```
SSE-G2252(config)#snmp-server view ifEntry.a 1.3.6.1.2.1.2.2.1.1.*
included
SSE-G2252(config)#
```

show snmp engine-id

This command shows the SNMP engine ID.

Command Mode

Privileged Exec

Example

This example shows the default engine ID.

```
SSE-G2252#show snmp engine-id
Local SNMP EngineID: 8000002a8000000000e8666672
Local SNMP EngineBoots: 1

Remote SNMP EngineID
IP address
800000000030004e2b316c54321                                    192.168.1.19
SSE-G2252#
```

Table 22-2. show snmp engine-id - Display Description

Field	Description
Local SNMP engineID	String identifying the engine ID.
Local SNMP engineBoots	The number of times that the engine has (re-)initialized since the snmp EngineID was last configured.
Remote SNMP engineID	String identifying an engine ID on a remote device.
IP address	IP address of the device containing the corresponding remote SNMP engine.

show snmp group

Four default groups are provided – SNMPv1 read-only access and read/write access, and SNMPv2c read-only access and read/write access.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show snmp group
Group Name: r&d
Security Model: v3
Read View: defaultview
Write View: daily
Notify View: none
Storage Type: permanent
Row Status: active

Group Name: public
Security Model: v1
```

```
Read View: defaultview
Write View: none
Notify View: none
Storage Type: volatile
Row Status: active

Group Name: public
Security Model: v2c
Read View: defaultview
Write View: none
Notify View: none
Storage Type: volatile
Row Status: active

Group Name: private
Security Model: v1
Read View: defaultview
Write View: defaultview
Notify View: none
Storage Type: volatile
Row Status: active

Group Name: private
Security Model: v2c
Read View: defaultview
Write View: defaultview
Notify View: none
Storage Type: volatile
Row Status: active

SSE-G2252#
```

Table 22-3. show snmp group - Display Description

Field	Description
groupname	Name of an SNMP group.
security model	The SNMP version.
readview	The associated read view.
writeview	The associated write view.
notifyview	The associated notify view.
storage-type	The storage type for this entry.
Row Status	The row status of this entry.

show snmp user

This command shows information on SNMP users.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show snmp user
```

```
EngineId: 800000ca030030f1df9ca00000
User Name: steve
Authentication Protocol: md5
Privacy Protocol: des56
Storage Type: nonvolatile
Row Status: active

SNMP remote user
EngineId: 80000000030004e2b316c54321
User Name: mark
Authentication Protocol: mdt
Privacy Protocol: des56
Storage Type: nonvolatile
Row Status: active

SSE-G2252#
```

Table 22-4. show snmp user - Display Description

Field	Description
EngineId	String identifying the engine ID.
User Name	Name of user connecting to the SNMP agent.
Authentication Protocol	The authentication protocol used with SNMPv3.
Privacy Protocol	The privacy protocol used with SNMPv3.
Storage Type	The storage type for this entry.
Row Status	The row status of this entry.
SNMP remote user	A user associated with an SNMP engine on a remote device.

show snmp view

This command shows information on the SNMP views.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show snmp view
View Name: mib-2
Subtree OID: 1.2.2.3.6.2.1
View Type: included
Storage Type: permanent
Row Status: active

View Name: defaultview
Subtree OID: 1
View Type: included
Storage Type: volatile
Row Status: active

SSE-G2252#
```

Table 22-5. show snmp view - Display Description

Field	Description
View Name	Name of an SNMP view.
Subtree OID	A branch in the MIB tree.
View Type	Indicates if the view is included or excluded.
Storage Type	The storage type for this entry.
Row Status	The row status of this entry.

nlm

This command enables or disables the specified notification log.

Syntax

[**no**] **nlm** *filter-name*

filter-name - Notification log name. (Range: 1-32 characters)

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

- Notification logging is enabled by default, but will not start recording information until a logging profile specified by the snmp-server notify-filter command is enabled by the **nlm** command.
- Disabling logging with this command does not delete the entries stored in the notification log.

Example

This example enables the notification logs A1 and A2.

```
SSE-G2252(config)#nlm A1
SSE-G2252(config)#nlm A2
SSE-G2252(config)#
```

snmp-server notify-filter

This command creates an SNMP notification log. Use the **no** form to remove this log.

Syntax

[**no**] **snmp-server notify-filter** *profile-name* **remote** *ip-address*

profile-name - Notification log profile name. (Range: 1-32 characters)

ip-address - The Internet address of a remote device. The specified target host must already have been configured using the snmp-server host command.

NOTE: The notification log is stored locally. It is not sent to a remote device. This remote host parameter is only required to complete mandatory fields in the SNMP Notification MIB.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Systems that support SNMP often need a mechanism for recording Notification information as a hedge against lost notifications, whether those are Traps or Informs that exceed retransmission limits. The Notification Log MIB (NLM, RFC 3014) provides an infrastructure in which information from other MIBs may be logged.
- Given the service provided by the NLM, individual MIBs can now bear less responsibility to record transient information associated with an event against the possibility that the Notification message is lost, and applications can poll the log to verify that they have not missed any important Notifications.
- If notification logging is not configured and enabled, when the switch reboots, some SNMP traps (such as warm start) cannot be logged.
- To avoid this problem, notification logging should be configured and enabled using the **snmp-server notify-filter** command and nlm command, and these commands stored in the startup configuration file. Then when the switch reboots, SNMP traps (such as warm start) can now be logged.
- When this command is executed, a notification log is created (with the default parameters defined in RFC 3014). Notification logging is enabled by default (see the nlm command), but will not start recording information until a logging profile specified with this command is enabled with the nlm command.
- Based on the default settings used in RFC 3014, a notification log can contain up to 256 entries, and the entry aging time is 1440 minutes. Information recorded in a notification log, and the entry aging time can only be configured using SNMP from a network management station.

- When a trap host is created with the snmp-server host command, a default notify filter will be created as shown in the example under the show snmp notify-filter command.

Example

This example first creates an entry for a remote host, and then instructs the switch to record this device as the remote host for the specified notification log.

```
SSE-G2252(config)#snmp-server host 10.1.19.23 batman
SSE-G2252(config)#snmp-server notify-filter A1 remote 10.1.19.23
SSE-G2252#
```

show nlm oper-status

This command shows the operational status of configured notification logs.

Command Mode

Privileged Exec

Example

```
SSE-G2252#sh nlm oper-status
Filter Name: A1
Oper-Status: Operational
Filter Name: A2
Oper-Status: Operational
SSE-G2252#
```

show snmp notify-filter

This command displays the configured notification logs.

Command Mode

Privileged Exec

Example

This example displays the configured notification logs and associated target hosts. Note that the last entry is a default filter created when a trap host is initially created.

```
SSE-G2252#show snmp notify-filter
Filter profile name            IP address
---------------------------  ----------------
A1                             10.1.19.23
A2                             10.1.19.22
traphost.1.1.1.1.private       1.1.1.1
SSE-G2252#
```

Chapter 23
Remote Monitoring Commands

Remote Monitoring allows a remote device to collect information or respond to specified events on an independent basis. This switch is an RMON-capable device which can independently perform a wide range of tasks, significantly reducing network management traffic. It can continuously run diagnostics and log information on network performance. If an event is triggered, it can automatically notify the network administrator of a failure and provide historical information about the event. If it cannot connect to the management agent, it will continue to perform any specified tasks and pass data back to the management station the next time it is contacted.

This switch supports mini-RMON, which consists of the Statistics, History, Event and Alarm groups. When RMON is enabled, the system gradually builds up information about its physical interfaces, storing this information in the relevant RMON database group. A management agent then periodically communicates with the switch using the SNMP protocol. However, if the switch encounters a critical event, it can automatically send a trap message to the management agent which can then respond to the event if so configured.

Table 23-1. RMON Commands

Command	Function	Mode
rmon alarm	Sets threshold bounds for a monitored variable	GC
rmon event	Creates a response event for an alarm	GC
rmon collection history	Periodically samples statistics	IC
rmon collection rmon1	Enables statistics collection	IC
show rmon alarms	Shows the settings for all configured alarms	PE
show rmon events	Shows the settings for all configured events	PE
show rmon history	Shows the sampling parameters for each entry	PE
show rmon statistics	Shows the collected statistics	PE

rmon alarm

This command sets threshold bounds for a monitored variable. Use the **no** form to remove an alarm.

Syntax

rmon alarm *index variable interval* {**absolute** | **delta**}
rising-threshold *threshold* [*event-index*] **falling-threshold** *threshold* [*event-index*]
[**owner** *name*]

no rmon alarm *index*

index – Index to this entry. (Range: 1-65535)

variable – The object identifier of the MIB variable to be sampled. Only variables of the type etherStatsEntry.n.n may be sampled. Note that etherStatsEntry.n uniquely defines the MIB variable, and etherStatsEntry.n.n defines the MIB variable, plus the etherStatsIndex. For example, 1.3.6.1.2.1.16.1.1.1.6.1 denotes etherStatsBroadcastPkts, plus the etherStatsIndex of 1.

interval – The polling interval. (Range: 1-31622400 seconds)

absolute – The variable is compared directly to the thresholds at the end of the sampling period.

delta – The last sample is subtracted from the current value and the difference is then compared to the thresholds.

threshold – An alarm threshold for the sampled variable. (Range: 0-2147483647)

event-index – The index of the event to use if an alarm is triggered. If there is no corresponding entry in the event control table, then no event will be generated. (Range: 0-65535)

name – Name of the person who created this entry. (Range: 1-127 characters)

Default Setting

1.3.6.1.2.1.16.1.1.1.6.1 - 1.3.6.1.2.1.16.1.1.1.6.50/52

Taking delta samples every 30 seconds,

Rising threshold is 892800, assigned to event 0

Falling threshold is 446400, assigned to event 0

Command Mode

Global Configuration

Command Usage

- If an event is already defined for an index, the entry must be deleted before any changes can be made with this command.

- If the current value is greater than or equal to the rising threshold, and the last sample value was less than this threshold, then an alarm will be generated. After a rising event has been generated, another such event will not be generated until the sampled value has fallen below the rising threshold, reaches the falling threshold, and again moves back up to the rising threshold.
- If the current value is less than or equal to the falling threshold, and the last sample value was greater than this threshold, then an alarm will be generated. After a falling event has been generated, another such event will not be generated until the sampled value has risen above the falling threshold, reaches the rising threshold, and again moves back down to the failing threshold.

Example

```
SSE-G2252(config)#rmon alarm 1 1 1.3.6.1.2.1.16.1.1.1.6.1 15 delta
rising-threshold 100 1 falling-threshold 30 1 owner mike
SSE-G2252(config)#
```

rmon event

This command creates a response event for an alarm. Use the **no** form to remove an event.

Syntax

rmon event *index* [**log**] | [**trap** *community*] | [**description** *string*] | [**owner** *name*]

no rmon event *index*

index – Index to this entry. (Range: 1-65535)

log – Generates an RMON log entry when the event is triggered. Log messages are processed based on the current configuration settings for event logging (see Section 21-6: "Event Logging" on page 21-37).

trap – Sends a trap message to all configured trap managers (see "snmp-server host" on page 22-8).

community – A password-like community string sent with the trap operation to SNMP v1 and v2c hosts. Although this string can be set using the rmon event command by itself, it is recommended that the string be defined using the snmp-server community command (page 22-3) prior to using the rmon event command. (Range: 1-127 characters)

string – A comment that describes this event. (Range: 1-127 characters)

name – Name of the person who created this entry. (Range: 1-127 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- If an event is already defined for an index, the entry must be deleted before any changes can be made with this command.
- The specified events determine the action to take when an alarm triggers this event. The response to an alarm can include logging the alarm or sending a message to a trap manager.

Example

```
SSE-G2252(config)#rmon event 2 log description urgent owner mike
SSE-G2252(config)#
```

rmon collection history

This command periodically samples statistics on a physical interface. Use the no form to disable periodic sampling.

Syntax

rmon collection history controlEntry *index*
[**buckets** *number* [**interval** *seconds*]] |
[**interval** *seconds*] |
[**owner** *name* [**buckets** *number* [**interval** *seconds*]]

no rmon collection history controlEntry *index*

index – Index to this entry. (Range: 1-65535)

number – The number of buckets requested for this entry. (Range: 1-65536)

seconds – The polling interval. (Range: 1-3600 seconds)

name – Name of the person who created this entry. (Range: 1-127 characters)

Default Setting

1.3.6.1.2.1.16.1.1.1.6.1 - 1.3.6.1.2.1.16.1.1.1.6.50/52

Buckets: 8

Interval: 30 seconds for even numbered entries, 1800 seconds for odd numbered entries

Command Mode

Interface Configuration (Ethernet)

Command Usage

- By default, each index number equates to a port on the switch, but can be changed to any number not currently in use.
- If periodic sampling is already enabled on an interface, the entry must be deleted before any changes can be made with this command.
- The information collected for each sample includes: input octets, packets, broadcast packets, multicast packets, undersize packets, oversize packets, fragments, jabbers, CRC alignment errors, collisions, drop events, and network utilization.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#rmon collection history 21 buckets 24 interval 60
owner mike
SSE-G2252(config-if)#
```

rmon collection rmon1

This command enables the collection of statistics on a physical interface. Use the no form to disable statistics collection.

Syntax

rmon collection rmon1 controlEntry *index* [**owner** *name*]

no rmon collection rmon1 controlEntry *index*

index – Index to this entry. (Range: 1-65535)

name – Name of the person who created this entry. (Range: 1-127 characters)

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

- By default, each index number equates to a port on the switch, but can be changed to any number not currently in use.
- If statistics collection is already enabled on an interface, the entry must be deleted before any changes can be made with this command.
- The information collected for each entry includes: input octets, packets, broadcast packets, multicast packets, undersize packets, oversize packets, fragments, jabbers, CRC alignment errors, collisions, drop events, and packets of specified lengths

Example

```
SSE-G2252(config)#interface ethernet 1/1
Console(config-if)#rmon collection rmon1 controlEntry 1 owner mike
SSE-G2252(config-if)#
```

show rmon alarms

This command shows the settings for all configured alarms.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show rmon alarms
Alarm 1 is valid, owned by
 Monitors 1.3.6.1.2.1.16.1.1.1.6.1 every 30 seconds
 Taking delta samples, last value was 0
 Rising threshold is 892800, assigned to event 0
 Falling threshold is 446400, assigned to event 0
.
.
.
```

show rmon events

This command shows the settings for all configured events.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show rmon events
Event 2 is valid, owned by mike
 Description is urgent
 Event firing causes log and trap to community , last fired  00:00:00
SSE-G2252#
```

show rmon history

This command shows the sampling parameters configured for each entry in the history group.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show rmon history
Entry 1 is valid, and owned by
 Monitors 1.3.6.1.2.1.2.2.1.1.1 every 1800 seconds
 Requested # of time intervals, ie buckets, is 8
 Granted # of time intervals, ie buckets, is 8
  Sample # 1 began measuring at 00:00:01
  Received 77671 octets, 1077 packets,
  61 broadcast and 978 multicast packets,
  0 undersized and 0 oversized packets,
  0 fragments and 0 jabbers packets,
  0 CRC alignment errors and 0 collisions.
  # of dropped packet events is 0
  Network utilization is estimated at 0
.
.
.
```

show rmon statistics

This command shows the information collected for all configured entries in the statistics group.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show rmon statistics
Interface 1 is valid, and owned by
 Monitors 1.3.6.1.2.1.2.2.1.1.1 which has
 Received 164289 octets, 2372 packets,
 120 broadcast and 2211 multicast packets,
 0 undersized and 0 oversized packets,
 0 fragments and 0 jabbers,
 0 CRC alignment errors and 0 collisions.
 # of dropped packet events (due to lack of resources): 0
 # of packets received of length (in octets):
  64: 2245, 65-127: 87, 128-255: 31,
  256-511: 5, 512-1023: 2, 1024-1518: 2
.
.
.
```

Chapter 24
Authentication Commands

You can configure this switch to authenticate users logging into the system for management access using local or remote authentication methods. Port-based authentication using IEEE 802.1X can also be configured to control either management access to the uplink ports or client access[1] to the data ports.

Table 24-1. Authentication Commands

Command Group	Function
User Accounts	Configures the basic user names and passwords for management access
Authentication Sequence	Defines logon authentication method and precedence
RADIUS Client	Configures settings for authentication via a RADIUS server
TACACS+ Client	Configures settings for authentication via a TACACS+ server
AAA	Configures authentication, authorization, and accounting for network access
Web Server	Enables management access via a web browser
Telnet Server	Enables management access via Telnet
Secure Shell	Provides secure replacement for Telnet
802.1X Port Authentication	Configures host authentication on specific ports using 802.1X
Management IP Filter	Configures IP addresses that are allowed management access

1. For other methods of controlling client access, see Chapter 25: "General Security Measures" on page 25-1.

24-1 User Accounts

The basic commands required for management access are listed in this section. This switch also includes other options for password checking via the console or a Telnet connection (page 21-24), user authentication via a remote authentication server (Section 24-2: "Authentication Sequence" on page 24-4), and host access authentication for specific ports (Section 24-9: "802.1X Port Authentication" on page 24-46).

Table 24-2. User Access Commands

Command	Function	Mode
enable password	Sets a password to control access to the Privileged Exec level	GC
username	Establishes a user name-based authentication system at login	GC

enable password

After initially logging onto the system, you should set the Privileged Exec password. Remember to record it in a safe place. This command controls access to the Privileged Exec level from the Normal Exec level. Use the **no** form to reset the default password.

Syntax

enable password [**level** *level*] {**0** | **7**} *password*

no enable password [**level** *level*]

level *level* - Level 15 for Privileged Exec. (Levels 0-14 are not used.)

{**0** | **7**} - 0 means plain password, 7 means encrypted password.

password - password for this privilege level. (Maximum length: 8 characters plain text, 32 encrypted, case sensitive)

Default Setting

The default is level 15. The default password is "super"

Command Mode

Global Configuration

Command Usage

You cannot set a null password. You will have to enter a password to change the command mode from Normal Exec to Privileged Exec with the enable command.

The encrypted password is required for compatibility with legacy password settings (i.e., plain text or encrypted) when reading the configuration file during system bootup or when downloading the configuration file from a TFTP server. There is no need for you to manually configure encrypted passwords.

Example

```
SSE-G2252(config)#enable password level 15 0 admin
SSE-G2252(config)#
```

Related Commands

"enable" on page 20-3

"authentication enable" on page 24-4

username

This command adds named users, requires authentication at login, specifies or changes a user's password (or specify that no password is required), or specifies or changes a user's access level. Use the **no** form to remove a user name.

Syntax

username *name* {**access-level** *level* | **nopassword** | **password** {**0** | **7**} *password*}

no username *name*

name - The name of the user. (Maximum length: 8 characters, case sensitive. Maximum users: 16)

access-level *level* - Specifies the user level.
The device has two predefined privilege levels: **0**: Normal Exec, **15**: Privileged Exec.

nopassword - No password is required for this user to log in.

{**0** | **7**} - 0 means plain password, 7 means encrypted password.

password *password* - The authentication password for the user. (Maximum length: 8 characters plain text, 32 encrypted, case sensitive)

Default Setting

The default access level is Normal Exec. The factory defaults for the user names and passwords are:

Table 24-3. Default Login Settings

username	access-level	password
guest	0	guest
ADMIN	15	ADMIN

Command Mode

Global Configuration

Command Usage

The encrypted password is required for compatibility with legacy password settings (i.e., plain text or encrypted) when reading the configuration file during system bootup or when downloading the configuration file from an FTP/TFTP server. There is no need for you to manually configure encrypted passwords.

Example

This example shows how the set the access level and password for a user.

```
SSE-G2252(config)#username bob access-level 15
SSE-G2252(config)#username bob password 0 smith
SSE-G2252(config)#
```

24-2 Authentication Sequence

Three authentication methods can be specified to authenticate users logging into the system for management access. The commands in this section can be used to define the authentication method and sequence.

Table 24-4. Authentication Sequence Commands

Command	Function	Mode
authentication enable	Defines the authentication method and precedence for command mode change	GC
authentication login	Defines logon authentication method and precedence	GC

authentication enable

This command defines the authentication method and precedence to use when changing from Exec command mode to Privileged Exec command mode with the enable command. Use the **no** form to restore the default.

Syntax

authentication enable {[**local**] [**radius**] [**tacacs**]}

no authentication enable

local - Use local password only.

radius - Use RADIUS server password only.

tacacs - Use TACACS server password.

Default Setting

Local

Command Mode

Global Configuration

Command Usage

- RADIUS uses UDP while TACACS+ uses TCP. UDP only offers best effort delivery, while TCP offers a connection-oriented transport. Also, note that RADIUS encrypts only the password in the access-request packet from the client to the server, while TACACS+ encrypts the entire body of the packet.
- RADIUS and TACACS+ logon authentication assigns a specific privilege level for each user name and password pair. The user name, password, and privilege level must be configured on the authentication server.
- You can specify three authentication methods in a single command to indicate the authentication sequence. For example, if you enter "**authentication enable radius tacacs local**," the user name and password on the RADIUS server is verified first. If the RADIUS server is not available, then authentication is attempted on the TACACS+ server. If the TACACS+ server is not available, the local user name and password is checked.

Example

```
SSE-G2252(config)#authentication enable radius
SSE-G2252(config)#
```

Related Commands

"enable password" on page 24-2 - sets the password for changing command modes

authentication login

This command defines the login authentication method and precedence. Use the no form to restore the default.

Syntax

authentication login {[**local]** [**radius**] [**tacacs**]}

no authentication login

local - Use local password.

radius - Use RADIUS server password.

tacacs - Use TACACS server password.

Default Setting

Local

Command Mode

Global Configuration

Command Usage

- RADIUS uses UDP while TACACS+ uses TCP. UDP only offers best effort delivery, while TCP offers a connection-oriented transport. Also, note that RADIUS encrypts only the password in the access-request packet from the client to the server, while TACACS+ encrypts the entire body of the packet.
- RADIUS and TACACS+ logon authentication assigns a specific privilege level for each user name and password pair. The user name, password, and privilege level must be configured on the authentication server.
- You can specify three authentication methods in a single command to indicate the authentication sequence. For example, if you enter "**authentication login radius tacacs local**," the user name and password on the RADIUS server is verified first. If the RADIUS server is not available, then authentication is attempted on the TACACS+ server. If the TACACS+ server is not available, the local user name and password is checked.

Example

```
SSE-G2252(config)#authentication login radius
SSE-G2252(config)#
```

Related Commands

"username" on page 24-3 - for setting the local user names and passwords

24-3 RADIUS Client

Remote Authentication Dial-in User Service (RADIUS) is a logon authentication protocol that uses software running on a central server to control access to RADIUS-aware devices on the network. An authentication server contains a database of multiple user name/password pairs with associated privilege levels for each user or group that require management access to a switch.

Table 24-5. RADIUS Client Commands

Command	Function	Mode
radius-server acct-port	Sets the RADIUS server network port	GC
radius-server auth-port	Sets the RADIUS server network port	GC
radius-server host	Specifies the RADIUS server	GC
radius-server key	Sets the RADIUS encryption key	GC
radius-server retransmit	Sets the number of retries	GC
radius-server timeout	Sets the interval between sending authentication requests	GC
show radius-server	Shows the current RADIUS settings	PE

radius-server acct-port

This command sets the RADIUS server network port for accounting messages. Use the **no** form to restore the default.

Syntax

radius-server acct-port *port-number*

no radius-server acct-port

port-number - RADIUS server UDP port used for accounting messages. (Range: 1-65535)

Default Setting

1813

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#radius-server acct-port 181
SSE-G2252(config)#
```

radius-server auth-port

This command sets the RADIUS server network port. Use the **no** form to restore the default.

Syntax

radius-server auth-port *port-number*

no radius-server auth-port

port-number - RADIUS server UDP port used for authentication messages. (Range: 1-65535)

Default Setting

1812

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#radius-server auth-port 181
SSE-G2252(config)#
```

radius-server host

This command specifies primary and backup RADIUS servers, and authentication and accounting parameters that apply to each server. Use the **no** form to remove a specified server, or to restore the default values.

Syntax

[**no**] **radius-server** *index* **host** *host-ip-address* [**acct-port** *acct-port*] [**auth-port** *auth-port*] [**key** *key*] [**retransmit** *retransmit*] [**timeout** *timeout*]

index - Allows you to specify up to five servers. These servers are queried in sequence until a server responds or the retransmit period expires.

host-ip-address - IP address of server.

acct-port - RADIUS server UDP port used for accounting messages. (Range: 1-65535)

auth-port - RADIUS server UDP port used for authentication messages. (Range: 1-65535)

key - Encryption key used to authenticate logon access for client. Do not use blank spaces in the string. (Maximum length: 48 characters)

retransmit - Number of times the switch will try to authenticate logon access via the RADIUS server. (Range: 1-30)

timeout - Number of seconds the switch waits for a reply before resending a request. (Range: 1-65535)

Default Setting

auth-port - 1812

acct-port - 1813

timeout - 5 seconds

retransmit - 2

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#radius-server 1 host 192.168.1.20 port 181 timeout 10
retransmit 5 key green
SSE-G2252(config)#
```

radius-server key

This command sets the RADIUS encryption key. Use the **no** form to restore the default.

Syntax

radius-server key *key-string*

no radius-server key

key-string - Encryption key used to authenticate logon access for client. Do not use blank spaces in the string. (Maximum length: 48 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#radius-server key green
SSE-G2252(config)#
```

radius-server retransmit

This command sets the number of retries. Use the **no** form to restore the default.

Syntax

radius-server retransmit *number-of-retries*

no radius-server retransmit

number-of-retries - Number of times the switch will try to authenticate logon access via the RADIUS server. (Range: 1 - 30)

Default Setting

2

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#radius-server retransmit 5
SSE-G2252(config)#
```

radius-server timeout

This command sets the interval between transmitting authentication requests to the RADIUS server. Use the **no** form to restore the default.

Syntax

radius-server timeout *number-of-seconds*

no radius-server timeout

number-of-seconds - Number of seconds the switch waits for a reply before resending a request. (Range: 1-65535)

Default Setting

5

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#radius-server timeout 10
SSE-G2252(config)#
```

show radius-server

This command displays the current settings for the RADIUS server.

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#show radius-server

Remote RADIUS Server Configuration:

Global Settings:
 Authentication Port Number : 1812
 Accounting Port Number     : 1813
 Retransmit Times           : 2
 Request Timeout            : 5
 Key                        :

Server 1:
 Server IP Address          : 192.168.1.1
 Authentication Port Number : 1812
 Accounting Port Number     : 1813
 Retransmit Times           : 2
 Request Timeout            : 5
 Key                        : *

Radius Server Group:
Group Name                Member Index
------------------------- -------------
radius                    1
SSE-G2252#
```

24-4 TACACS+ Client

Terminal Access Controller Access Control System (TACACS+) is a logon authentication protocol that uses software running on a central server to control access to TACACS-aware devices on the network. An authentication server contains a database of multiple user name/password pairs with associated privilege levels for each user or group that require management access to a switch.

Table 24-6. TACACS+ Client Commands

Command	Function	Mode
tacacs-server host	Specifies the TACACS+ server and optional parameters	GC
tacacs-server key	Sets the TACACS+ encryption key	GC
tacacs-server port	Specifies the TACACS+ server network port	GC
show tacacs-server	Shows the current TACACS+ settings	GC

tacacs-server host

This command specifies the TACACS+ server and other optional parameters. Use the **no** form to remove the server, or to restore the default values.

Syntax

tacacs-server *index* **host** *host-ip-address* [**key** *key*] [**port** *port-number*] [**retransmit** *retransmit*] [**timeout** *timeout*]

no tacacs-server *index*

index - The index for this server. (Range: 1)

host-ip-address - IP address of a TACACS+ server.

key - Encryption key used to authenticate logon access for the client. Do not use blank spaces in the string. (Maximum length: 48 characters)

port-number - TACACS+ server TCP port used for authentication messages. (Range: 1-65535)

retransmit - Number of times the switch will try to authenticate logon access via the TACACS+ server. (Range: 1-30)

timeout - Number of seconds the switch waits for a reply before resending a request. (Range: 1-540)

Default Setting

authentication port - 49

timeout - 4 seconds

retransmit - 2

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#tacacs-server 1 host 192.168.1.25 port 181 timeout 10
retransmit 5 key green
SSE-G2252(config)#
```

tacacs-server key

This command sets the TACACS+ encryption key. Use the **no** form to restore the default.

Syntax

tacacs-server key *key-string*

no tacacs-server key

key-string - Encryption key used to authenticate logon access for the client. Do not use blank spaces in the string. (Maximum length: 48 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#tacacs-server key green
SSE-G2252(config)#
```

tacacs-server port

This command specifies the TACACS+ server network port. Use the no form to restore the default.

Syntax

tacacs-server port *port-number*

no tacacs-server port

port-number - TACACS+ server TCP port used for authentication messages. (Range: 1-65535)

Default Setting

49

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#tacacs-server port 181
SSE-G2252(config)#
```

show tacacs-server

This command displays the current settings for the TACACS+ server.

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#show tacacs-server

Remote TACACS+ server configuration:

Global settings:
 Server Port Number : 49
 Key                : *

Server 1:
 Server IP Address  : 192.168.1.25
 Server Port Number : 181
 Server Time Out : 4
 Key                : *

SSE-G2252#
```

24-5 AAA

The Authentication, Authorization, and Accounting (AAA) feature provides the main framework for configuring access control on the switch. The AAA functions require the use of configured RADIUS or TACACS+ servers in the network.

Table 24-7. AAA Commands

Command	Function	Mode
aaa accounting commands	Enables accounting of Exec mode commands	GC
aaa accounting dot1x	Enables accounting of 802.1X services	GC
aaa accounting exec	Enables accounting of Exec services	GC
aaa accounting update	Enables periodoc updates to be sent to the accounting server	GC
aaa authorization exec	Enables authorization of Exec sessions	GC
aaa group server	Groups security servers in to defined lists	GC
server	Configures the IP address of a server in a group list	SG
accounting dot1x	Applies an accounting method to an interface for 802.1X service requests	IC
accounting exec	Applies an accounting method to local console, Telnet or SSH connections	Line
authorization exec	Applies an authorization method to local console, Telnet or SSH connections	Line
show accounting	Displays all accounting information	PE

aaa accounting commands

This command enables the accounting of Exec mode commands. Use the **no** form to disable the accounting service.

Syntax

aaa accounting commands *level* {**default** | *method-name*} **start-stop group** {**tacacs+** |*server-group*}

no aaa accounting commands *level* {**default** | *method-name*}

level - The privilege level for executing commands. (Range: 0-15)

default - Specifies the default accounting method for service requests.

method-name - Specifies an accounting method for service requests. (Range: 1-255 characters)

start-stop - Records accounting from starting point and stopping point.

group - Specifies the server group to use.

tacacs+ - Specifies all TACACS+ hosts configure with the tacacs-server host command.

server-group - Specifies the name of a server group configured with the aaa group server command. (Range: 1-255 characters)

Default Setting

Accounting is not enabled

No servers are specified

Command Mode

Global Configuration

Command Usage

- The accounting of Exec mode commands is only supported by TACACS+ servers.
- Note that the **default** and *method-name* fields are only used to describe the accounting method(s) configured on the specified TACACS+ server, and do not actually send any information to the server about the methods to use.

Example

```
SSE-G2252(config)#aaa accounting commands 15 default start-stop group
tacacs+
SSE-G2252(config)#
```

aaa accounting dot1x

This command enables the accounting of requested 802.1X services for network access. Use the **no** form to disable the accounting service.

Syntax

aaa accounting dot1x {**default** | *method-name*}
start-stop group {**radius** | **tacacs+** |*server-group*}

no aaa accounting dot1x {**default** | *method-name*}

default - Specifies the default accounting method for service requests.

method-name - Specifies an accounting method for service requests. (Range: 1-255 characters)

start-stop - Records accounting from starting point and stopping point.

group - Specifies the server group to use.

radius - Specifies all RADIUS hosts configure with the radius-server host command.

tacacs+ - Specifies all TACACS+ hosts configure with the tacacs-server host command.

server-group - Specifies the name of a server group configured with the aaa group server command. (Range: 1-255 characters)

Default Setting

Accounting is not enabled

No servers are specified

Command Mode

Global Configuration

Command Usage

Note that the **default** and *method-name* fields are only used to describe the accounting method(s) configured on the specified RADIUS or TACACS+ servers, and do not actually send any information to the servers about the methods to use.

Example

```
SSE-G2252(config)#aaa accounting dot1x default start-stop group radius
SSE-G2252(config)#
```

aaa accounting exec

This command enables the accounting of requested Exec services for network access. Use the **no** form to disable the accounting service.

Syntax

aaa accounting exec {**default** | *method-name*}
start-stop group {**radius** | **tacacs+** |*server-group*}

no aaa accounting exec {**default** | *method-name*}

default - Specifies the default accounting method for service requests.

method-name - Specifies an accounting method for service requests. (Range: 1-255 characters)

start-stop - Records accounting from starting point and stopping point.

group - Specifies the server group to use.

radius - Specifies all RADIUS hosts configure with the radius-server host command.

tacacs+ - Specifies all TACACS+ hosts configure with the tacacs-server host command.

server-group - Specifies the name of a server group configured with the aaa group server command. (Range: 1-255 characters)

Default Setting

Accounting is not enabled

No servers are specified

Command Mode

Global Configuration

Command Usage

- This command runs accounting for Exec service requests for the local console and Telnet connections.
- Note that the **default** and *method-name* fields are only used to describe the accounting method(s) configured on the specified RADIUS or TACACS+ servers, and do not actually send any information to the servers about the methods to use.

Example

```
SSE-G2252(config)#aaa accounting exec default start-stop group tacacs+
SSE-G2252(config)#
```

aaa accounting update

This command enables the sending of periodic updates to the accounting server. Use the **no** form to restore the default setting.

Syntax

aaa accounting update [**periodic** *interval*]

no aaa accounting update

interval - Sends an interim accounting record to the server at this interval. (Range: 0-2147483647 minutes; where 0 means disabled)

Default Setting

1 minute

Command Mode

Global Configuration

Command Usage

- When accounting updates are enabled, the switch issues periodic interim accounting records for all users on the system.
- Using the command without specifying an interim interval enables updates, but does not change the current interval setting.

Example

```
SSE-G2252(config)#aaa accounting update periodic 30
SSE-G2252(config)#
```

aaa authorization exec

This command enables the authorization for Exec access. Use the **no** form to disable the authorization service.

Syntax

aaa authorization exec {**default** | *method-name*}
group {**tacacs+** | *server-group*}

no aaa authorization exec {**default** | *method-name*}

default - Specifies the default authorization method for Exec access.

method-name - Specifies an authorization method for Exec access. (Range: 1-255 characters)

group - Specifies the server group to use.

tacacs+ - Specifies all TACACS+ hosts configured with the tacacs-server host command.

server-group - Specifies the name of a server group configured with the aaa group server command. (Range: 1-255 characters)

Default Setting

Authorization is not enabled

No servers are specified

Command Mode

Global Configuration

Command Usage

- This command performs authorization to determine if a user is allowed to run an Exec shell.
- AAA authentication must be enabled before authorization is enabled.
- If this command is issued without a specified named method, the default method list is applied to all interfaces or lines (where this authorization type applies), except those that have a named method explicitly defined.

Example

```
SSE-G2252(config)#aaa authorization exec default group tacacs+
SSE-G2252(config)#
```

aaa group server

Use this command to name a group of security server hosts. To remove a server group from the configuration list, enter the **no** form of this command.

Syntax

[**no**] **aaa group server** {**radius** | **tacacs+**} *group-name*

radius - Defines a RADIUS server group.

tacacs+ - Defines a TACACS+ server group.

group-name - A text string that names a security server group. (Range: 1-7 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#aaa group server radius tps
SSE-G2252(config-sg-radius)#
```

server

This command adds a security server to an AAA server group. Use the **no** form to remove the associated server from the group.

Syntax

[**no**] **server** {*index* | *ip-address*}

index - Specifies the server index. (Range: RADIUS 1-5, TACACS+ 1)

ip-address - Specifies the host IP address of a server.

Default Setting

None

Command Mode

Server Group Configuration

Command Usage

- When specifying the index for a RADIUS server, that server index must already be defined by the radius-server host command.
- When specifying the index for a TACACS+ server, that server index must already be defined by the tacacs-server host command.

Example

```
SSE-G2252(config)#aaa group server radius tps
SSE-G2252(config-sg-radius)#server 10.2.68.120
SSE-G2252(config-sg-radius)#
```

accounting dot1x

This command applies an accounting method for 802.1X service requests on an interface. Use the **no** form to disable accounting on the interface.

Syntax

accounting dot1x {**default** | *list-name*}

no accounting dot1x

default - Specifies the default method list created with the aaa accounting dot1x command.

list-name - Specifies a method list created with the aaa accounting dot1x command.

Default Setting

None

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface ethernet 1/2
SSE-G2252(config-if)#accounting dot1x tps
SSE-G2252(config-if)#
```

accounting exec

This command applies an accounting method to local console, Telnet or SSH connections. Use the **no** form to disable accounting on the line.

Syntax

accounting exec {**default** | *list-name*}

no accounting exec

default - Specifies the default method list created with the aaa accounting exec command.

list-name - Specifies a method list created with the aaa accounting exec command.

Default Setting

None

Command Mode

Line Configuration

Example

```
SSE-G2252(config)#line console
SSE-G2252(config-line)#accounting exec tps
SSE-G2252(config-line)#exit
SSE-G2252(config)#line vty
SSE-G2252(config-line)#accounting exec default
SSE-G2252(config-line)#
```

authorization exec

This command applies an authorization method to local console, Telnet or SSH connections. Use the **no** form to disable authorization on the line.

Syntax

authorization exec {**default** | *list-name*}
no authorization exec

default - Specifies the default method list created with the aaa authorization exec command.

list-name - Specifies a method list created with the aaa authorization exec command.

Default Setting

None

Command Mode

Line Configuration

Example

```
SSE-G2252(config)#line console
SSE-G2252(config-line)#authorization exec tps
SSE-G2252(config-line)#exit
SSE-G2252(config)#line vty
SSE-G2252(config-line)#authorization exec default
SSE-G2252(config-line)#
```

show accounting

This command displays the current accounting settings per function and per port.

Syntax

show accounting [[**dot1x** [**statistics** [**username** *user-name* | **interface** *interface*]] | **exec** [**statistics**] | **statistics**]

level - Displays command accounting information for a specifiable command level.

dot1x - Displays dot1x accounting information.

exec - Displays Exec accounting records.

statistics - Displays accounting records.

user-name - Displays accounting records for a specifiable username.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#show accounting
Accounting type: dot1x
  Method List   : default
  Group List    : radius
  Interface     : Eth 1/1
  Method List   : tps
  Group List    : radius
  Interface     : Eth 1/2
Accounting type: Exec
  Method List   : default
  Group List    : tacacs+
  Interface     : vty
SSE-G2252#
```

24-6 Web Server

This section describes commands used to configure web browser management access to the switch.

Table 24-8. Web Server Commands

Command	Function	Mode
ip http port	Specifies the port to be used by the web browser interface	GC
ip http server	Allows the switch to be monitored or configured from a browser	GC
ip http secure-server	Enables HTTPS (HTTP/SSL) for encrypted communications	GC
ip http secure-port	Specifies the UDP port number for HTTPS	GC

NOTE: Users are automatically logged off of the HTTP server or HTTPS server if no input is detected for 600 seconds.

ip http port

This command specifies the TCP port number used by the web browser interface. Use the no form to use the default port.

Syntax

ip http port *port-number*

no ip http port

port-number - The TCP port to be used by the browser interface. (Range: 1-65535)

Default Setting

80

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#ip http port 769
SSE-G2252(config)#
```

Related Commands

"ip http server" on page 24-28

"show system" on page 21-8

ip http server

This command allows this device to be monitored or configured from a browser. Use the **no** form to disable this function.

Syntax

[**no**] **ip http server**

Default Setting

Enabled

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#ip http server
SSE-G2252(config)#
```

Related Commands

"ip http port" on page 24-27

"show system" on page 21-8

ip http secure-server

This command enables the secure hypertext transfer protocol (HTTPS) over the Secure Socket Layer (SSL), providing secure access (i.e., an encrypted connection) to the switch's web interface. Use the **no** form to disable this function.

Syntax

[**no**] **ip http secure-server**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- HTTP and HTTPS are implemented as mutually exclusive services on the switch.
- If you enable HTTPS, you must indicate this in the URL that you specify in your browser: **https**://*device*[:*port_number*]
- When you start HTTPS, the connection is established in this way:
  - The client authenticates the server using the server's digital certificate.
  - The client and server negotiate a set of security protocols to use for the connection.
  - The client and server generate session keys for encrypting and decrypting data.
- The client and server establish a secure encrypted connection.

  A padlock icon should appear in the status bar for Internet Explorer 5.x or above, Netscape Navigator 6.2 or above, and Mozilla Firefox 2.0.0.0 or above.

  The following web browsers and operating systems currently support HTTPS:

Table 24-9. HTTPS System Support

Web Browser	Operating System
Internet Explorer 5.0 or later	Windows 98,Windows NT (with service pack 6a), Windows 2000, Windows XP, Windows Vista, Windows 7
Netscape Navigator 6.2 or later	Windows 98,Windows NT (with service pack 6a), Windows 2000, Windows XP, Solaris 2.6
Mozilla Firefox 2.0.0.0 or later	Windows 2000, Windows XP, Linux

- To specify a secure-site certificate, see "Replacing the Default Secure-site Certificate" on page 302. Also refer to the copy tftp https-certificate command.
- Connection to the web interface is not supported for HTTPS using an IPv6 link local address.

Example

```
SSE-G2252(config)#ip http secure-server
SSE-G2252(config)#
```

Related Commands

"ip http secure-port" on page 24-30

copy tftp https-certificate on page 21-15

"show system" on page 21-8

ip http secure-port

This command specifies the UDP port number used for HTTPS connection to the switch's web interface. Use the **no** form to restore the default port.

Syntax

ip http secure-port *port_number*

no ip http secure-port

port_number – The UDP port used for HTTPS. (Range: 1-65535)

Default Setting

443

Command Mode

Global Configuration

Command Usage

- If you change the HTTPS port number, clients attempting to connect to the HTTPS server must specify the port number in the URL, in this format: **https://***device***:***port_number*

Example

```
SSE-G2252(config)#ip http secure-port 1000
SSE-G2252(config)#
```

Related Commands

"ip http secure-server" on page 24-28

"show system" on page 21-8

24-7 Telnet Server

This section describes commands used to configure Telnet management access to the switch.

Table 24-10. Telnet Server Commands

Command	Function	Mode
ip telnet max-sessions	Specifies the maximum number of Telnet sessions that can simultaneously connect to this system	GC
ip telnet port	Specifies the port to be used by the Telnet interface	GC
ip telnet server	Allows the switch to be monitored or configured from Telnet	GC
show ip telnet	Displays configuration settings for the Telnet server	PE

NOTE: This switch also supports a Telnet client function. A Telnet connection can be made from this switch to another device by entering the **telnet** command at the Privileged Exec configuration level.

ip telnet max-sessions

This command specifies the maximum number of Telnet sessions that can simultaneously connect to this system. Use the **no** from to restore the default setting.

Syntax

ip telnet max-sessions *session-count*

no ip telnet max-sessions

session-count - The maximum number of allowed Telnet session. (Range: 0-4)

Default Setting

4 sessions

Command Mode

Global Configuration

Command Usage

A maximum of four sessions can be concurrently opened for Telnet and Secure Shell (i.e., both Telnet and SSH share a maximum number or four sessions).

Example

```
SSE-G2252(config)#ip telnet max-sessions 1
SSE-G2252(config)#
```

ip telnet port

This command specifies the TCP port number used by the Telnet interface. Use the **no** form to use the default port.

Syntax

ip telnet port *port-number*

no telnet port

port-number - The TCP port number to be used by the browser interface. (Range: 1-65535)

Default Setting

23

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#ip telnet port 123
SSE-G2252(config)#
```

ip telnet server

This command allows this device to be monitored or configured from Telnet. Use the **no** form to disable this function.

Syntax

[**no**] **ip telnet server**

Default Setting

Enabled

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#ip telnet server
SSE-G2252(config)#
```

show ip telnet

This command displays the configuration settings for the Telnet server.

Command Mode

Normal Exec, Privileged Exec

Example

```
SSE-G2252#show ip telnet
IP Telnet Configuration:

Telnet Status: Enabled
Telnet Service Port: 23
Telnet Max Session: 4
SSE-G2252#
```

24-8 Secure Shell

This section describes the commands used to configure the SSH server. Note that you also need to install a SSH client on the management station when using this protocol to configure the switch.

NOTE: The switch supports both SSH Version 1.5 and 2.0 clients.

Table 24-11. Secure Shell Commands

Command	Function	Mode
ip ssh authentication-retries	Specifies the number of retries allowed by a client	GC
ip ssh server	Enables the SSH server on the switch	GC
ip ssh server-key size	Sets the SSH server key size	GC
ip ssh timeout	Specifies the authentication timeout for the SSH server	GC
copy tftp public-key	Copies the user's public key from a TFTP server to the switch	PE
delete public-key	Deletes the public key for the specified user	PE
disconnect	Terminates a line connection	PE
ip ssh crypto host-key generate	Generates the host key	PE
ip ssh crypto zeroize	Clear the host key from RAM	PE
ip ssh save host-key	Saves the host key from RAM to flash memory	PE
show ip ssh	Displays the status of the SSH server and the configured values for authentication timeout and retries	PE
show public-key	Shows the public key for the specified user or for the host	PE
show ssh	Displays the status of current SSH sessions	PE
show users	Shows SSH users, including privilege level and public key type	PE

Configuration Guidelines

The SSH server on this switch supports both password and public key authentication. If password authentication is specified by the SSH client, then the password can be authenticated either locally or via a RADIUS or TACACS+ remote authentication server, as specified by the authentication login command. If public key authentication is specified by the client, then you must configure authentication keys on both the client and the switch as described in the following section. Note that regardless of whether you use public key or password authentication, you still have to generate authentication keys on the switch and enable the SSH server.

To use the SSH server, complete these steps:

1. Generate a Host Key Pair – Use the ip ssh crypto host-key generate command to create a host public/private key pair.
2. Provide Host Public Key to Clients – Many SSH client programs automatically import the host public key during the initial connection setup with the switch. Otherwise, you need to manually create a known hosts file on the management station and place the host public key in it. An entry for a public key in the known hosts file would appear similar to the following example:

   ```
   10.1.0.54 1024 35
   156849954018676692593339467750546173253136748908365472 54
   150202455931998685443583616519999233297817660658309 56
   108259132128902337654680172627257141342876294130119619556678259566410 4
   869574278881462065194174677298486546861571773939016477935594230357741 3
   098022737087794545240839717526463580581767167095748047761 17
   ```

3. Import Client's Public Key to the Switch – Use the copy tftp public-key command to copy a file containing the public key for all the SSH client's granted management access to the switch. (Note that these clients must be configured locally on the switch with the username command.) The clients are subsequently authenticated using these keys. The current firmware only accepts public key files based on standard UNIX format as shown in the following example for an RSA key:

   ```
   1024 35
   134108168560989392104094492015542534763164192187295892114317388005553 6
   161631051775940838686311092912322268285192543746031009371877211996963 1
   781366277414168985132049117204830392543241016379975923714490119380060
   902539484084827178194372288402533115952134861022902978982721353267131 6
   294325328189150453063939166 43 steve@192.168.1.19
   ```

4. Set the Optional Parameters – Set other optional parameters, including the authentication timeout, the number of retries, and the server key size.
5. Enable SSH Service – Use the ip ssh server command to enable the SSH server on the switch.
6. *Authentication* – One of the following authentication methods is employed:

   Password Authentication (for SSH v1.5 or V2 Clients)

   a. The client sends its password to the server.

   b. The switch compares the client's password to those stored in memory.

   c. If a match is found, the connection is allowed.

NOTE: To use SSH with only password authentication, the host public key must still be given to the client, either during initial connection or manually entered into the known host file. However, you do not need to configure the client's keys.

Public Key Authentication – When an SSH client attempts to contact the switch, the SSH server uses the host key pair to negotiate a session key and encryption method. Only clients that have a private key corresponding to the public keys stored on the switch can access it. The following exchanges take place during this process:

Authenticating SSH v1.5 Clients

a. The client sends its RSA public key to the switch.

b. The switch compares the client's public key to those stored in memory.

c. If a match is found, the switch uses its secret key to generate a random 256-bit string as a challenge, encrypts this string with the user's public key, and sends it to the client.

d. The client uses its private key to decrypt the challenge string, computes the MD5 checksum, and sends the checksum back to the switch.

e. The switch compares the checksum sent from the client against that computed for the original string it sent. If the two check sums match, this means that the client's private key corresponds to an authorized public key, and the client is authenticated.

Authenticating SSH v2 Clients

a. The client first queries the switch to determine if DSA public key authentication using a preferred algorithm is acceptable.

b. If the specified algorithm is supported by the switch, it notifies the client to proceed with the authentication process. Otherwise, it rejects the request.

c. The client sends a signature generated using the private key to the switch.

d. When the server receives this message, it checks whether the supplied key is acceptable for authentication, and if so, it then checks whether the signature is correct. If both checks succeed, the client is authenticated.

NOTE: The SSH server supports up to four client sessions. The maximum number of client sessions includes both current Telnet sessions and SSH sessions.

ip ssh authentication-retries

This command configures the number of times the SSH server attempts to reauthenticate a user. Use the **no** form to restore the default setting.

Syntax

ip ssh authentication-retries *count*

no ip ssh authentication-retries

count – The number of authentication attempts permitted after which the interface is reset. (Range: 1-5)

Default Setting

3

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#ip ssh authentication-retires 2
SSE-G2252(config)#
```

Related Commands

"show ip ssh" on page 24-43

ip ssh server

This command enables the Secure Shell (SSH) server on this switch. Use the **no** form to disable this service.

Syntax

[**no**] **ip ssh server**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- The SSH server supports up to four client sessions. The maximum number of client sessions includes both current Telnet sessions and SSH sessions.
- The SSH server uses DSA or RSA for key exchange when the client first establishes a connection with the switch, and then negotiates with the client to select either DES (56-bit) or 3DES (168-bit) for data encryption.
- You must generate DSA and RSA host keys before enabling the SSH server.

Example

```
SSE-G2252#ip ssh crypto host-key generate dsa
SSE-G2252#configure
SSE-G2252(config)#ip ssh server
SSE-G2252(config)#
```

Related Commands

"ip ssh crypto host-key generate" on page 24-41

"show ssh" on page 24-44

ip ssh server-key size

This command sets the SSH server key size. Use the **no** form to restore the default setting.

Syntax

ip ssh server-key size *key-size*

no ip ssh server-key size

key-size – The size of server key. (Range: 512-896 bits)

Default Setting

768 bits

Command Mode

Global Configuration

Command Usage

The server key is a private key that is never shared outside the switch.

The host key is shared with the SSH client, and is fixed at 1024 bits.

Example

```
SSE-G2252(config)#ip ssh server-key size 512
SSE-G2252(config)#
```

ip ssh timeout

This command configures the timeout for the SSH server. Use the **no** form to restore the default setting.

Syntax

ip ssh timeout *seconds*

no ip ssh timeout

seconds – The timeout for client response during SSH negotiation. (Range: 1-120)

Default Setting

10 seconds

Command Mode

Global Configuration

Command Usage

The **timeout** specifies the interval the switch will wait for a response from the client during the SSH negotiation phase. Once an SSH session has been established, the timeout for user input is controlled by the exec-timeout copy command for vty sessions.

Example

```
SSE-G2252(config)#ip ssh timeout 60
SSE-G2252(config)#
```

RELATED COMMANDS

"exec-timeout" on page 21-26

"show ip ssh" on page 24-43

delete public-key

This command deletes the specified user's public key.

Syntax

delete public-key *username* [**dsa** | **rsa**]

username – Name of an SSH user. (Range: 1-8 characters)

dsa – DSA public key type.

rsa – RSA public key type.

Default Setting

Deletes both the DSA and RSA key.

Command Mode

Privileged Exec

Example

```
SSE-G2252#delete public-key admin dsa
SSE-G2252#
```

ip ssh crypto host-key generate

This command generates the host key pair (i.e., public and private).

Syntax

ip ssh crypto host-key generate [**dsa** | **rsa**]

dsa – DSA (Version 2) key type.

rsa – RSA (Version 1) key type.

Default Setting

Generates both the DSA and RSA key pairs.

Command Mode

Privileged Exec

Command Usage

- The switch uses only RSA Version 1 for SSHv1.5 clients and DSA Version 2 for SSHv2 clients.
- This command stores the host key pair in memory (i.e., RAM). Use the ip ssh save host-key command to save the host key pair to flash memory.
- Some SSH client programs automatically add the public key to the known hosts file as part of the configuration process. Otherwise, you must manually create a known hosts file and place the host public key in it.
- The SSH server uses this host key to negotiate a session key and encryption method with the client trying to connect to it.

Example

```
SSE-G2252#ip ssh crypto host-key generate dsa
SSE-G2252#
```

Related Commands

"ip ssh crypto zeroize" on page 24-42

"ip ssh save host-key" on page 24-43

ip ssh crypto zeroize

This command clears the host key from memory (i.e. RAM).

Syntax

ip ssh crypto zeroize [**dsa** | **rsa**]

dsa – DSA key type.

rsa – RSA key type.

Default Setting

Clears both the DSA and RSA key.

Command Mode

Privileged Exec

Command Usage

- This command clears the host key from volatile memory (RAM). Use the **no** ip ssh save host-key command to clear the host key from flash memory.
- The SSH server must be disabled before you can execute this command.

Example

```
SSE-G2252#ip ssh crypto zeroize dsa
SSE-G2252#
```

Related Commands

"ip ssh crypto host-key generate" on page 24-41

"ip ssh save host-key" on page 24-43

"ip ssh server" on page 24-38

ip ssh save host-key

This command saves the host key from RAM to flash memory.

Syntax

ip ssh save host-key

Default Setting

Saves both the DSA and RSA key.

Command Mode

Privileged Exec

Example

```
SSE-G2252#ip ssh save host-key dsa
SSE-G2252#
```

Related Commands

"ip ssh crypto host-key generate" on page 24-41

show ip ssh

This command displays the connection settings used when authenticating client access to the SSH server.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip ssh
SSH Enabled - Version 2.0
Negotiation Timeout : 120 seconds; Authentication Retries : 3
Server Key Size     : 768 bits
SSE-G2252#
```

show public-key

This command shows the public key for the specified user or for the host.

Syntax

show public-key [**user** [*username*]| **host**]

username – Name of an SSH user. (Range: 1-8 characters)

Default Setting

Shows all public keys.

Command Mode

Privileged Exec

Command Usage

- If no parameters are entered, all keys are displayed. If the user keyword is entered, but no user name is specified, then the public keys for all users are displayed.
- When an RSA key is displayed, the first field indicates the size of the host key (e.g., 1024), the second field is the encoded public exponent (e.g., 35), and the last string is the encoded modulus. When a DSA key is displayed, the first field indicates that the encryption method used by SSH is based on the Digital Signature Standard (DSS), and the last string is the encoded modulus.

Example

```
SSE-G2252#show public-key host
Host:
RSA:
1024 65537 13236940658254764031382795526536375927835525327972629521130241
07194210616557594245909392360969540503627752575562510038661309893938345 23
10332802149888661921595568598879891919505883940181387440468908779160305 83
77681854900028313416250083487184495220874292122556916656552963281635169 64
04083155476606641516571163 81
DSA:
ssh-dss AAAB3NzaC1kc3MAAACBAPWKZTPbsRIB8ydEXcxM3dyV/yrDbKStIlnzD/Dg0h2Hxc
YV44sXZ2JXhamLK6P8bvuiyacWbUW/a4PAtp1KMSdqsKeh3hKoA3vRRSy1N2XFfAKxl5fwFfv
JlPdOkFgzLGMinvSNYQwiQXbKTBH0Z4mUZpE85PWxDZMaCNBPjBrRAAAAFQChb4vsdfQGNIjw
bvwrNLaQ77isiwAAAIEAsy5YWDC99ebYHNRj5kh47wY4i8cZvH+/p9cnrfwFTMU01VFDly3IR
2G395NLy5Qd7ZDxfA9mCOfT/yyEfbobMJZi8oGCstSNOxrZZVnMqWrTYfdrKX7YKBw/Kjw6Bm
iFq7O+jAhf1Dg45loAc27s6TLdtny1wRq/ow2eTCD5nekAAACBAJ8rMccXTxHLFAczWS7EjOy
DbsloBfPuSAb4oAsyjKXKVYNLQkTLZfcFRu41bS2KV5LAwecsigF/+DjKGWtPNIQqabKgYCw2
o/dVzX4Gg+yqdTlYmGA7fHGm8ARGeiG4ssFKy4Z6DmYPXFum1Yg0fhLwuHpOSKdxT3kk475S7
w0W
SSE-G2252#
```

show ssh

This command displays the current SSH server connections.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ssh
Connection Version State                Username Encryption
  0          2.0   Session-Started      admin    ctos aes128-cbc-hmac-md5
                                                 stoc aes128-cbc-hmac-md5
SSE-G2252#
```

Table 24-12. show ssh - Display Description

Field	Description
Session	The session number. (Range: 0-3)
Version	The Secure Shell version number.
State	The authentication negotiation state. (Values: Negotiation-Started, Authentication-Started, Session-Started)
Username	The user name of the client.

24-9 802.1X Port Authentication

The switch supports IEEE 802.1X (dot1x) port-based access control that prevents unauthorized access to the network by requiring users to first submit credentials for authentication. Client authentication is controlled centrally by a RADIUS server using EAP (Extensible Authentication Protocol).

Table 24-13. 802.1X Port Authentication Commands

Command	Function	Mode
General Commands		
dot1x default	Resets all dot1x parameters to their default values	GC
dot1x eapol-pass-through	Passes EAPOL frames to all ports in STP forwarding state when dot1x is globally disabled	GC
dot1x system-auth-control	Enables dot1x globally on the switch.	GC
Authenticator Commands		
dot1x intrusion-action	Sets the port response to intrusion when authentication fails	IC
dot1x max-req	Sets the maximum number of times that the switch retransmits an EAP request/identity packet to the client before it times out the authentication session	IC
dot1x operation-mode	Allows single or multiple hosts on an dot1x port	IC
dot1x port-control	Sets dot1x mode for a port interface	IC
dot1x re-authentication	Enables re-authentication for all ports	IC
dot1x timeout quiet-period	Sets the time that a switch port waits after the Max Request Count has been exceeded before attempting to acquire a new client	IC
dot1x timeout re-authperiod	Sets the time period after which a connected client must be re-authenticated	IC
dot1x timeout supp-timeout	Sets the interval for a supplicant to respond	IC
dot1x timeout tx-period	Sets the time period during an authentication session that the switch waits before re-transmitting an EAP packet	IC
dot1x re-authenticate	Forces re-authentication on specific ports	PE
Supplicant Commands		
dot1x identity profile	Configures dot1x supplicant user name and password	GC
dot1x max-start	Sets the maximum number of times that a port supplicant will send an EAP start frame to the client	IC
dot1x pae supplicant	Enables dot1x supplicant mode on an interface	IC
dot1x timeout auth-period	Sets the time that a supplicant port waits for a response from the authenticator	IC
dot1x timeout held-period	Sets the time a port waits after the maximum start count has been exceeded before attempting to find another authenticator	IC

Table 24-13. 802.1X Port Authentication Commands (Continued)

Command	Function	Mode
dot1x timeout start-period	Sets the time that a supplicant port waits before resending an EAPOL start frame to the authenticator	IC
Display Information Commands		
show dot1x	Shows all dot1x related information	PE

dot1x default

This command sets all configurable dot1x global and port settings to their default values.

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#dot1x default
SSE-G2252(config)#
```

dot1x eapol-pass-through

This command passes EAPOL frames through to all ports in STP forwarding state when dot1x is globally disabled. Use the **no** form to restore the default.

Syntax

[**no**] **dot1x eapol-pass-through**

Default Setting

Discards all EAPOL frames when dot1x is globally disabled

Command Mode

Global Configuration

Command Usage

- When this device is functioning as intermediate node in the network and does not need to perform dot1x authentication, the **dot1x eapol pass-through** command can be used to forward EAPOL frames from other switches on to the authentication servers, thereby allowing the authentication process to still be carried out by switches located on the edge of the network.
- When this device is functioning as an edge switch but does not require any attached clients to be authenticated, the **no dot1x eapol-pass-through** command can be used to discard unnecessary EAPOL traffic.

Example

This example instructs the switch to pass all EAPOL frame through to any ports in STP forwarding state.

```
SSE-G2252(config)#dot1x eapol-pass-through
SSE-G2252(config)#
```

dot1x system-auth-control

This command enables IEEE 802.1X port authentication globally on the switch. Use the **no** form to restore the default.

Syntax

[**no**] **dot1x system-auth-control**

Default Setting

Disabled

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#dot1x system-auth-control
SSE-G2252(config)#
```

dot1x intrusion-action

This command sets the port's response to a failed authentication, either to block all traffic, or to assign all traffic for the port to a guest VLAN. Use the **no** form to reset the default.

Syntax

dot1x intrusion-action {**block-traffic** | **guest-vlan**}

no dot1x intrusion-action

block-traffic - Blocks traffic on this port.

guest-vlan - Assigns the user to the Guest VLAN.

Default

block-traffic

Command Mode

Interface Configuration

Command Usage

For guest VLAN assignment to be successful, the VLAN must be configured and set as active (see the vlan database command) and assigned as the guest VLAN for the port (see the network-access guest-vlan command).

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x intrusion-action guest-vlan
SSE-G2252(config-if)#
```

dot1x max-req

This command sets the maximum number of times the switch port will retransmit an EAP request/identity packet to the client before it times out the authentication session. Use the **no** form to restore the default.

Syntax

dot1x max-req *count*

no dot1x max-req

count – The maximum number of requests (Range: 1-10)

Default

2

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x max-req 2
SSE-G2252(config-if)#
```

dot1x operation-mode

This command allows hosts (clients) to connect to an 802.1X-authorized port. Use the **no** form with no keywords to restore the default to single host. Use the **no** form with the **multi-host max-count** keywords to restore the default maximum count.

Syntax

dot1x operation-mode {**single-host** | **multi-host** [**max-count** *count*] | **mac-based-auth**}

no dot1x operation-mode [**multi-host max-count**]

single-host – Allows only a single host to connect to this port.

multi-host – Allows multiple host to connect to this port.

max-count – Keyword for the maximum number of hosts.

count – The maximum number of hosts that can connect to a port. (Range: 1-1024; Default: 5)

mac-based – Allows multiple hosts to connect to this port, with each host needing to be authenticated.

Default

Single-host

Command Mode

Interface Configuration

Command Usage

- The "max-count" parameter specified by this command is only effective if the dot1x mode is set to "auto" by the dot1x port-control command.
- In "multi-host" mode, only one host connected to a port needs to pass authentication for all other hosts to be granted network access. Similarly, a port can become unauthorized for all hosts if one attached host fails re-authentication or sends an EAPOL logoff message.
- In "mac-based-auth" mode, each host connected to a port needs to pass authentication. The number of hosts allowed access to a port operating in this mode is limited only by the available space in the secure address table (i.e., up to 1024 addresses).

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x operation-mode multi-host max-count 10
SSE-G2252(config-if)#
```

dot1x port-control

This command sets the dot1x mode on a port interface. Use the **no** form to restore the default.

Syntax

dot1x port-control {**auto** | **force-authorized** | **force-unauthorized**}

no dot1x port-control

auto – Requires a dot1x-aware connected client to be authorized by the RADIUS server. Clients that are not dot1x-aware will be denied access.

force-authorized – Configures the port to grant access to all clients, either dot1x-aware or otherwise.

force-unauthorized – Configures the port to deny access to all clients, either dot1x-aware or otherwise.

Default

force-authorized

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x port-control auto
SSE-G2252(config-if)#
```

dot1x re-authentication

This command enables periodic re-authentication for a specified port. Use the **no** form to disable re-authentication.

Syntax

[**no**] **dot1x re-authentication**

Command Mode

Interface Configuration

Command Usage

- The re-authentication process verifies the connected client's user ID and password on the RADIUS server. During re-authentication, the client remains connected the network and the process is handled transparently by the dot1x client software. Only if re-authentication fails is the port blocked.
- The connected client is re-authenticated after the interval specified by the dot1x timeout re-authperiod command. The default is 3600 seconds.

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x re-authentication
SSE-G2252(config-if)#
```

Related Commands

"dot1x timeout re-authperiod" on page 24-54

dot1x timeout quiet-period

This command sets the time that a switch port waits after the maximum request count (see "dot1x max-req" on page 24-49) has been exceeded before attempting to acquire a new client. Use the **no** form to reset the default.

Syntax

dot1x timeout quiet-period *seconds*

no dot1x timeout quiet-period

seconds - The number of seconds. (Range: 1-65535)

Default

60 seconds

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x timeout quiet-period 350
SSE-G2252(config-if)#
```

dot1x timeout re-authperiod

This command sets the time period after which a connected client must be re-authenticated. Use the **no** form of this command to reset the default.

Syntax

dot1x timeout re-authperiod *seconds*

no dot1x timeout re-authperiod

seconds - The number of seconds. (Range: 1-65535)

Default

3600 seconds

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x timeout re-authperiod 300
SSE-G2252(config-if)#
```

dot1x timeout supp-timeout

This command sets the time that an interface on the switch waits for a response to an EAP request from a client before re-transmitting an EAP packet. Use the **no** form to reset to the default value.

Syntax

dot1x timeout supp-timeout *seconds*

no dot1x timeout supp-timeout

seconds - The number of seconds. (Range: 1-65535)

Default

30 seconds

Command Mode

Interface Configuration

Command Usage

This command sets the timeout for EAP-request frames other than EAP-request/identity frames. If dot1x authentication is enabled on a port, the switch will initiate authentication when the port link state comes up. It will send an EAP-request/identity frame to the client to request its identity, followed by one or more requests for authentication information. It may also send other EAP-request frames to the client during an active connection as required for reauthentication.

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x timeout supp-timeout 300
SSE-G2252(config-if)#
```

dot1x timeout tx-period

This command sets the time that an interface on the switch waits during an authentication session before re-transmitting an EAP packet. Use the **no** form to reset to the default value.

Syntax

dot1x timeout tx-period *seconds*

no dot1x timeout tx-period

seconds - The number of seconds. (Range: 1-65535)

Default

30 seconds

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x timeout tx-period 300
SSE-G2252(config-if)#
```

dot1x re-authenticate

This command forces re-authentication on all ports or a specific interface.

Syntax

dot1x re-authenticate [*interface*]

interface - ethernet unit/port unit - Un mber. (Range: 1-52)

Command Mode

Privileged Exec

Command Usage

The re-authentication process verifies the connected client's user ID and password on the RADIUS server. During re-authentication, the client remains connected the network and the process is handled transparently by the dot1x client software. Only if re-authentication fails is the port blocked.

Example

```
SSE-G2252#dot1x re-authenticate
SSE-G2252#
```

dot1x identity profile

This command sets the dot1x supplicant user name and password. Use the **no** form to delete the identity settings.

Syntax

dot1x identity profile {**username** *username* | **password** *password*}

no dot1x identity profile {**username** | **password**}

username - Specifies the supplicant user name. (Range: 1-8 characters)

password - Specifies the supplicant password. (Range: 1-8 characters)

Default

No user name or password

Command Mode

Global Configuration

Command Usage

The global supplicant user name and password are used to identify this switch as a supplicant when responding to an MD5 challenge from the authenticator. These parameters must be set when this switch passes client authentication requests to another authenticator on the network (see "dot1x pae supplicant" on page 24-60).

Example

```
SSE-G2252(config)#dot1x identity profile username steve
SSE-G2252(config)#dot1x identity profile password excess
SSE-G2252(config)#
```

dot1x max-start

This command sets the maximum number of times that a port supplicant will send an EAP start frame to the client before assuming that the client is 802.1X unaware. Use the **no** form to restore the default value.

Syntax

dot1x max-start *count*

no dot1x max-start

count - Specifies the maximum number of EAP start frames. (Range: 1-65535)

Default

3

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x max-start 10
SSE-G2252(config-if)#
```

dot1x pae supplicant

This command enables dot1x supplicant mode on a port. Use the **no** form to disable dot1x supplicant mode on a port.

Syntax

[**no**] **dot1x pae supplicant**

Default

Disabled

Command Mode

Interface Configuration

Command Usage

- When devices attached to a port must submit requests to another authenticator on the network, configure the identity profile parameters (see "dot1x identity profile" on page 24-58) which identify this switch as a supplicant, and enable dot1x supplicant mode for those ports which must authenticate clients through a remote authenticator using this command. In this mode the port will not respond to dot1x messages meant for an authenticator.
- This switch can be configured to serve as the authenticator on selected ports by setting the control mode to "auto" (see "dot1x port-control" on page 24-51), and as a supplicant on other ports by the setting the control mode to "force-authorized" and enabling dot1x supplicant mode with this command.
- A port cannot be configured as a dot1x supplicant if it is a member of a trunk or LACP is enabled on the port.

Example

```
Console(config)#interface ethernet 1/2
Console(config-if)#dot1x pae supplicant
Console(config-if)#
```

dot1x timeout auth-period

This command sets the time that a supplicant port waits for a response from the authenticator. Use the **no** form to restore the default setting.

Syntax

dot1x timeout auth-period *seconds*

no dot1x timeout auth-period

seconds - The number of seconds. (Range: 1-65535)

Default

30 seconds

Command Mode

Interface Configuration

Command Usage

This command sets the time that the supplicant waits for a response from the authenticator for packets other than EAPOL-Start.

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x timeout auth-period 60
SSE-G2252(config-if)#
```

dot1x timeout held-period

This command sets the time that a supplicant port waits before resending its credentials to find a new an authenticator. Use the **no** form to reset the default.

Syntax

dot1x timeout held-period *seconds*

no dot1x timeout held-period

seconds - The number of seconds. (Range: 1-65535)

Default

60 seconds

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x timeout held-period 120
SSE-G2252(config-if)#
```

dot1x timeout start-period

This command sets the time that a supplicant port waits before resending an EAPOL start frame to the authenticator. Use the **no** form to restore the default setting.

Syntax

dot1x timeout start-period *seconds*

no dot1x timeout start-period

seconds - The number of seconds. (Range: 1-65535)

Default

30 seconds

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface eth 1/2
SSE-G2252(config-if)#dot1x timeout start-period 60
SSE-G2252(config-if)#
```

show dot1x

This command shows general port authentication related settings on the switch or a specific interface.

Syntax

show dot1x [**statistics**] [**interface** *interface*]

statistics - Displays dot1x status for each port.

interface

ethernet unit/port

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Command Mode

Privileged Exec

Command Usage

This command displays the following information:

- *Global 802.1X Parameters* – Shows whether or not 802.1X port authentication is globally enabled on the switch ("dot1x system-auth-control" on page 24-48).
- *Authenticator Parameters* – Shows whether or not EAPOL pass-through is enabled (page 24-47).
- *Supplicant Parameters* – Shows the supplicant user name used when the switch responds to an MD5 challenge from an authenticator ("dot1x identity profile" on page 24-58).
- *802.1X Port Summary* – Displays the port access control parameters for each interface that has enabled 802.1X, including the following items:
  - Type – Administrative state for port access control (Enabled, Authenticator, or Supplicant).
  - Operation Mode – Allows single or multiple hosts ("dot1x operation-mode" on page 24-50).
  - Control Mode – Dot1x port control mode ("dot1x port-control" on page 24-51).
  - Authorized – Authorization status (yes or n/a - not authorized).
- *802.1X Port Details* – Displays the port access control parameters for each interface, including the following items:
  - Reauthentication – Periodic re-authentication ("dot1x re-authentication" on page 24-52).

- Reauth Period – Time after which a connected client must be re-authenticated ("dot1x timeout re-authperiod" on page 24-54).
- Quiet Period – Time a port waits after Max Request Count is exceeded before attempting to acquire a new client ("Related Commands" on page 24-52).
- TX Period – Time a port waits during authentication session before re-transmitting EAP packet ("dot1x timeout tx-period" on page 24-56).
- Supplicant Timeout – Supplicant timeout.
- Server Timeout – Server timeout.
- Reauth Max Retries – Maximum number of reauthentication attempts.
- Max Request – Maximum number of times a port will retransmit an EAP request/identity packet to the client before it times out the authentication session ("dot1x max-req" on page 24-49).
- Operation Mode – Shows if single or multiple hosts (clients) can connect to an 802.1X-authorized port.
- Port Control – Shows the dot1x mode on a port as auto, force-authorized, or force-unauthorized ("dot1x port-control" on page 24-51).
- Intrusion Action – Sets the port response to intrusion when authentication fails ("dot1x intrusion-action" on page 24-48).
- Supplicant – MAC address of authorized client.

- *Authenticator State Machine*
  - State – Current state (including initialize, disconnected, connecting, authenticating, authenticated, aborting, held, force_authorized, force_unauthorized).
  - Reauth Count– Number of times connecting state is re-entered.
  - Current Identifier – The integer (0-255) used by the Authenticator to identify the current authentication session.
- *Backend State Machine*
  - State – Current state (including request, response, success, fail, timeout, idle, initialize).
  - Request Count – Number of EAP Request packets sent to the Supplicant without receiving a response.
  - Identifier (Server) – Identifier carried in the most recent EAP Success, Failure or Request packet received from the Authentication Server.
- *Reauthentication State Machine*
  - State – Current state (including initialize, reauthenticate).

Example

```
SSE-G2252#show dot1x
Global 802.1X Parameters
 System Auth Control       : Enabled

Authenticator Parameters:
 EAPOL Pass Through        : Disabled

Supplicant Parameters:
 Identity Profile Username : steve

802.1X Port Summary

Port     Type          Operation Mode Control Mode       Authorized
-------- ------------- -------------- ------------------ ----------
Eth 1/ 1 Disabled      Single-Host    Force-Authorized   Yes
Eth 1/ 2 Disabled      Single-Host    Force-Authorized   Yes
.
.
.
Eth 1/49 Disabled      Single-Host    Force-Authorized   Yes
Eth 1/50 Enabled       Single-Host    Auto               Yes

802.1X Port Details

802.1X Authenticator is enabled on port 1/1

802.1X Supplicant is disabled on port 1/1

.
.
.
802.1X Authenticator is enabled on port 50
Reauthentication     : Enabled
Reauth Period        : 3600
Quiet Period         : 60
TX Period            : 30
Supplicant Timeout   : 30
Server Timeout       : 10
Reauth Max Retries   : 2
Max Request          : 2
Operation Mode       : Multi-host
Port Control         : Auto
Intrusion Action     : Block traffic

Supplicant           : 00-e0-29-94-34-65


Authenticator PAE State Machine
 State               : Authenticated
 Reauth Count        : 0
 Current Identifier  : 3

Backend State Machine
 State               : Idle
 Request Count       : 0
 Identifier(Server)  : 2

Reauthentication State Machine
```

```
 State                : Initialize

SSE-G2252#
```

24-10Management IP Filter

This section describes commands used to configure IP management access to the switch.

Table 24-14. Management IP Filter Commands

Command	Function	Mode
management	Configures IP addresses that are allowed management access	GC
show management	Displays the switch to be monitored or configured from a browser	PE

management

This command specifies the client IP addresses that are allowed management access to the switch through various protocols. Use the **no** form to restore the default setting.

Syntax

[**no**] **management** {**all-client** | **http-client** | **snmp-client** | **telnet-client**} *start-address* [*end-address*]

all-client - Adds IP address(es) to all groups.

http-client - Adds IP address(es) to the web group.

snmp-client - Adds IP address(es) to the SNMP group.

telnet-client - Adds IP address(es) to the Telnet group.

start-address - A single IP address, or the starting address of a range.

end-address - The end address of a range.

Default Setting

All addresses

Command Mode

Global Configuration

Command Usage

- If anyone tries to access a management interface on the switch from an invalid address, the switch will reject the connection, enter an event message in the system log, and send a trap message to the trap manager.

- IP address can be configured for SNMP, web, and Telnet access respectively. Each of these groups can include up to five different sets of addresses, either individual addresses or address ranges.
- When entering addresses for the same group (i.e., SNMP, web, or Telnet), the switch will not accept overlapping address ranges. When entering addresses for different groups, the switch will accept overlapping address ranges.
- You cannot delete an individual address from a specified range. You must delete the entire range, and reenter the addresses.
- You can delete an address range just by specifying the start address, or by specifying both the start address and end address.

Example

This example restricts management access to the indicated addresses.

```
SSE-G2252(config)#management all-client 192.168.1.19
SSE-G2252(config)#management all-client 192.168.1.25 192.168.1.30
SSE-G2252#
```

show management

This command displays the client IP addresses that are allowed management access to the switch through various protocols.

Syntax

show management {**all-client** | **http-client** | **snmp-client** | **telnet-client**}

all-client - Displays IP addresses for all groups.

http-client - Displays IP addresses for the web group.

snmp-client - Displays IP addresses for the SNMP group.

telnet-client - Displays IP addresses for the Telnet group.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show management all-client
Management Ip Filter
 HTTP-Client:
   Start IP address      End IP address
-----------------------------------------------
1. 192.168.1.19          192.168.1.19
2. 192.168.1.25          192.168.1.30

 SNMP-Client:
   Start IP address      End IP address
-----------------------------------------------
1. 192.168.1.19          192.168.1.19
2. 192.168.1.25          192.168.1.30

 TELNET-Client:
   Start IP address      End IP address
-----------------------------------------------
1. 192.168.1.19          192.168.1.19
2. 192.168.1.25          192.168.1.30

SSE-G2252#
```

Notes

Chapter 25
General Security Measures

This switch supports many methods of segregating traffic for clients attached to each of the data ports, and for ensuring that only authorized clients gain access to the network. Port-based authentication using IEEE 802.1X is commonly used for these purposes. In addition to these method, several other options of providing client security are described in this chapter. These include port-based authentication, which can be configured to allow network client access by specifying a fixed set of MAC addresses. The addresses assigned to DHCP clients can also be carefully controlled with IP Source Guard and DHCP Snooping commands.

Table 25-1. General Security Commands

Command Group	Function
Port Security[a]	Configures secure addresses for a port
802.1X Port Authentication[a]	Configures host authentication on specific ports using 802.1X
Network Access (MAC Address Authentication)	Configures MAC authentication and dynamic VLAN assignment
Web Authentication[a]	Configures Web authentication
Access Control Lists*	Provides filtering for IP frames (based on address, protocol, TCP/UDP port number or TCP control code) or non-IP frames (based on MAC address or Ethernet type)
DHCP Snooping[a]	Filters untrusted DHCP messages on unsecure ports by building and maintaining a DHCP snooping binding table
IP Source Guard[a]	Filters IP traffic on insecure ports for which the source address cannot be identified via DHCP snooping nor static source bindings
ARP Inspection	Validates the MAC-to-IP address bindings in ARP packets

a. The priority of execution for these filtering commands is Port Security, Port Authentication, Network Access, Web Authentication, Access Control Lists, DHCP Snooping, and then IP Source Guard.

25-1 Port Security

These commands can be used to configure the maximum number of device MAC addresses that can be learned by a switch port, and to enable port security on a port.

When port security is enabled on a port, the switch stops learning new MAC addresses on the specified port when it has reached a configured maximum number. Only incoming traffic with source addresses already stored in the address table will be authorized to access the network through that port. If a device with an unauthorized MAC address attempts to use the switch port, the intrusion will be detected and the switch can automatically take action by disabling the port and sending a trap message.

Table 25-2. Management IP Filter Commands

Command	Function	Mode
mac-address-table static	Maps a static address to a port in a VLAN	GC
port security	Configures a secure port	IC
show mac-address-table	Displays entries in the bridge-forwarding database	PE

port security

This command enables or configures port security. Use the **no** form without any keywords to disable port security. Use the **no** form with the appropriate keyword to restore the default settings for a response to security violation or for the maximum number of allowed addresses.

Syntax

port security
[[**action** {**shutdown** | **trap** | **trap-and-shutdown**}] |
[**max-mac-count** *address-count*]]

no port security [**action** | **max-mac-count**]

action - Response to take when port security is violated.

shutdown - Disable port only.

trap - Issue SNMP trap message only.

trap-and-shutdown - Issue SNMP trap message and disable port.

max-mac-count

address-count - The maximum number of MAC addresses that can be learned on a port. (Range: 0 - 1024, where 0 means disabled)

Default Setting

Status: Disabled

Action: None

Maximum Addresses: 0

Command Mode

Interface Configuration (Ethernet)

Command Usage

- The default maximum number of MAC addresses allowed on a secure port is zero (that is, disabled). To use port security, you must configure the maximum number of addresses allowed on a port using the **port security max-mac-count** command.
- When port security is enabled using the **port security** command, the switch first clears all dynamically learned entries from the address table. It then starts learning new MAC addresses on the specified port, and stops learning addresses when it reaches a configured maximum number. Only incoming traffic with source addresses already stored in the address table will be accepted.
- To configure the maximum number of address entries which can be learned on a port, first disable port security on a port using the **no port security** command, and then specify the maximum number of dynamic addresses allowed. The switch will learn up to the maximum number of allowed address pairs <source MAC address, VLAN> for frames received on the port. (The specified maximum address count is effective when port security is enabled or disabled.) Note that you can manually add additional secure addresses to a port using the mac-address-table static command. When the port has reached the maximum number of MAC addresses, the port will stop learning new addresses. The MAC addresses already in the address table will be retained and will not be aged out.
- If port security is enabled, and the maximum number of allowed addresses are set to a non-zero value, any device not in the address table that attempts to use the port will be prevented from accessing the switch.
- If a port is disabled due to a security violation, it must be manually re-enabled using the no shutdown command.
- A secure port has the following restrictions:
  - Cannot be connected to a network interconnection device.
  - Cannot be a trunk port.

Example

The following example enables port security for port 5, and sets the response to a security violation to issue a trap message:

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#port security action trap
```

Related Commands

"show interfaces status" on page 27-15

"shutdown" on page 27-10

"mac-address-table static" on page 33-2

25-2 Network Access (MAC Address Authentication)

Network Access authentication controls access to the network by authenticating the MAC address of each host that attempts to connect to a switch port. Traffic received from a specific MAC address is forwarded by the switch only if the source MAC address is successfully authenticated by a central RADIUS server. While authentication for a MAC address is in progress, all traffic is blocked until authentication is completed. Once successfully authenticated, the RADIUS server may optionally assign VLAN and QoS settings for the switch port.

Table 25-3. Network Access Commands

Command	Function	Mode
network-access aging	Enables MAC address aging	GC
network-access mac-filter	Adds a MAC address to a filter table	GC
mac-authentication reauth-time	Sets the time period after which a connected MAC address must be re-authenticated	GC
network-access dynamic-qos	Enables the dynamic quality of service feature	IC
network-access dynamic-vlan	Enables dynamic VLAN assignment from a RADIUS server	IC
network-access guest-vlan	Specifies the guest VLAN	IC
network-access link-detection	Enables the link detection feature	IC
network-access link-detection link-down	Configures the link detection feature to detect and act upon link-down events	IC
network-access link-detection link-up	Configures the link detection feature to detect and act upon link-up events	IC
network-access link-detection link-up-down	Configures the link detection feature to detect and act upon both link-up and link-down events	IC
network-access max-mac-count	Sets the maximum number of MAC addresses that can be authenticated on a port via all forms of authentication	IC
network-access mode mac-authentication	Enables MAC authentication on an interface	IC
network-access port-mac-filter	Enables the specified MAC address filter	IC
mac-authentication intrusion-action	Determines the port response when a connected host fails MAC authentication.	IC
mac-authentication max-mac-count	Sets the maximum number of MAC addresses that can be authenticated on a port via MAC authentication	IC
clear network-access	Clears authenticated MAC addresses from the address table	PE

Table 25-3. Network Access Commands (Continued)

Command	Function	Mode
show network-access	Displays the MAC authentication settings for port interfaces	PE
show network-access mac-address-table	Displays information for entries in the secure MAC address table	PE
show network-access mac-filter	Displays information for entries in the MAC filter tables	PE

network-access aging

Use this command to enable aging for authenticated MAC addresses stored in the secure MAC address table. Use the **no** form of this command to disable address aging.

Syntax

[**no**] **network-access aging**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- Authenticated MAC addresses are stored as dynamic entries in the switch's secure MAC address table and are removed when the aging time expires. The address aging time is determined by the mac-address-table aging-time command.
- This parameter applies to authenticated MAC addresses configured by the MAC Address Authentication process described in this section, as well as to any secure MAC addresses authenticated by 802.1X, regardless of the 802.1X Operation Mode (Single-Host, Multi-Host, or MAC-Based authentication as described on page 24-50).
- The maximum number of secure MAC addresses supported for the switch system is 1024.

Example

```
SSE-G2252(config-if)#network-access aging
SSE-G2252(config-if)#
```

network-access mac-filter

Use this command to add a MAC address into a filter table. Use the **no** form of this command to remove the specified MAC address.

Syntax

[**no**] **network-access mac-filter** *filter-id*
mac-address *mac-address* [**mask** *mask-address*]

filter-id - Specifies a MAC address filter table. (Range: 1-64)

mac-address - Specifies a MAC address entry. (Format: xx-xx-xx-xx-xx-xx)

mask - Specifies a MAC address bit mask for a range of addresses.

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- Specified addresses are exempt from network access authentication.
- This command is different from configuring static addresses with the mac-address-table static command in that it allows you configure a range of addresses when using a mask, and then to assign these addresses to one or more ports with the network-access port-mac-filter command.
- Up to 64 filter tables can be defined.
- There is no limitation on the number of entries that can entered in a filter table.

Example

```
SSE-G2252(config)#network-access mac-filter 1 mac-address
11-22-33-44-55-66
SSE-G2252(config)#
```

mac-authentication reauth-time

Use this command to set the time period after which a connected MAC address must be re-authenticated. Use the **no** form of this command to restore the default value.

Syntax

mac-authentication reauth-time *seconds*

no mac-authentication reauth-time

seconds - The reauthentication time period. (Range: 120-1000000 seconds)

Default Setting

1800

Command Mode

Global Configuration

Command Usage

- The reauthentication time is a global setting and applies to all ports.
- When the reauthentication time expires for a secure MAC address it is reauthenticated with the RADIUS server. During the reauthentication process traffic through the port remains unaffected.

Example

```
SSE-G2252(config)#mac-authentication reauth-time 300
SSE-G2252(config)#
```

network-access dynamic-qos

Use this command to enable the dynamic QoS feature for an authenticated port. Use the **no** form to restore the default.

Syntax

[**no**] **network-access dynamic-qos**

Default Setting

Disabled

Command Mode

Interface Configuration

Command Usage

- The RADIUS server may optionally return dynamic QoS assignments to be applied to a switch port for an authenticated user. The "Filter-ID" attribute (attribute 11) can be configured on the RADIUS server to pass the following QoS information:

Table 25-4. Dynamic QoS Profiles

Profile	Attribute Syntax	Example
DiffServ	**service-policy-in**=*policy-map-name*	service-policy-in=p1
Rate Limit	**rate-limit-input**=*rate*	rate-limit-input=100 (Kbps)
802.1p	**switchport-priority-default**=*value*	switchport-priority-default=2
IP ACL	**ip-access-group-in**=*ip-acl-name*	ip-access-group-in=ipv4acl
IPv6 ACL	**ipv6-access-group-in**=*ipv6-acl-name*	ipv6-access-group-in=ipv6acl
MAC ACL	**mac-access-group-in**=*mac-acl-name*	mac-access-group-in=macAcl

- When the last user logs off of a port with a dynamic QoS assignment, the switch restores the original QoS configuration for the port.
- When a user attempts to log into the network with a returned dynamic QoS profile that is different from users already logged on to the same port, the user is denied access.
- While a port has an assigned dynamic QoS profile, any manual QoS configuration changes only take effect after all users have logged off of the port.

NOTE: Any configuration changes for dynamic QoS are not saved to the switch configuration file.

Example

The following example enables the dynamic QoS feature on port 1.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#network-access dynamic-qos
SSE-G2252(config-if)#
```

network-access dynamic-vlan

Use this command to enable dynamic VLAN assignment for an authenticated port. Use the **no** form to disable dynamic VLAN assignment.

Syntax

[**no**] **network-access dynamic-vlan**

Default Setting

Enabled

Command Mode

Interface Configuration

Command Usage

- When enabled, the VLAN identifiers returned by the RADIUS server will be applied to the port, providing the VLANs have already been created on the switch. GVRP is not used to create the VLANs.
- The VLAN settings specified by the first authenticated MAC address are implemented for a port. Other authenticated MAC addresses on the port must have same VLAN configuration, or they are treated as an authentication failure.
- If dynamic VLAN assignment is enabled on a port and the RADIUS server returns no VLAN configuration, the authentication is still treated as a success, and the host assigned to the default untagged VLAN.
- When the dynamic VLAN assignment status is changed on a port, all authenticated addresses are cleared from the secure MAC address table.

Example

The following example enables dynamic VLAN assignment on port 1.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#network-access dynamic-vlan
SSE-G2252(config-if)#
```

network-access guest-vlan

Use this command to assign all traffic on a port to a guest VLAN when 802.1x authentication is rejected. Use the **no** form of this command to disable guest VLAN assignment.

Syntax

network-access guest-vlan *vlan-id*

no network-access guest-vlan

vlan-id - VLAN ID (Range: 1-4093)

Default Setting

Disabled

Command Mode

Interface Configuration

Command Usage

- The VLAN to be used as the guest VLAN must be defined and set as active (See the vlan database command).
- When used with 802.1X authentication, the intrusion-action must be set for "guest-vlan" to be effective (see the dot1x intrusion-action command).

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#network-access guest-vlan 25
SSE-G2252(config-if)#
```

network-access link-detection

Use this command to enable link detection for the selected port. Use the **no** form of this command to restore the default.

Syntax

[**no**] **network-access link-detection**

Default Setting

Disabled

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#network-access link-detection
SSE-G2252(config-if)#
```

network-access link-detection link-down

Use this command to detect link-down events. When detected, the switch can shut down the port, send an SNMP trap, or both. Use the **no** form of this command to disable this feature.

Syntax

network-access link-detection link-down
action [**shutdown** | **trap** | **trap-and-shutdown**]

no network-access link-detection

action - Response to take when port security is violated.

shutdown - Disable port only.

trap - Issue SNMP trap message only.

trap-and-shutdown - Issue SNMP trap message and disable the port.

Default Setting

Disabled

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#network-access link-detection link-down action trap
SSE-G2252(config-if)#
```

network-access link-detection link-up

Use this command to detect link-up events. When detected, the switch can shut down the port, send an SNMP trap, or both. Use the **no** form of this command to disable this feature.

Syntax

network-access link-detection link-up
action [**shutdown** | **trap** | **trap-and-shutdown**]

no network-access link-detection

action - Response to take when port security is violated.

shutdown - Disable port only.

trap - Issue SNMP trap message only.

trap-and-shutdown - Issue SNMP trap message and disable the port.

Default Setting

Disabled

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#network-access link-detection link-up action trap
SSE-G2252(config-if)#
```

network-access link-detection link-up-down

Use this command to detect link-up and link-down events. When either event is detected, the switch can shut down the port, send an SNMP trap, or both. Use the **no** form of this command to disable this feature.

Syntax

network-access link-detection link-up-down
action [**shutdown** | **trap** | **trap-and-shutdown**]

no network-access link-detection

action - Response to take when port security is violated.

shutdown - Disable port only.

trap - Issue SNMP trap message only.

trap-and-shutdown - Issue SNMP trap message and disable the port.

Default Setting

Disabled

Command Mode

Interface Configuration

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#network-access link-detection link-up-down action
trap
SSE-G2252(config-if)#
```

network-access max-mac-count

Use this command to set the maximum number of MAC addresses that can be authenticated on a port interface via all forms of authentication. Use the **no** form of this command to restore the default.

Syntax

network-access max-mac-count *count*

no network-access max-mac-count

count - The maximum number of authenticated IEEE 802.1X and MAC addresses allowed. (Range: 0-1024; 0 for unlimited)

Default Setting

1024

Command Mode

Interface Configuration

Command Usage

The maximum number of MAC addresses per port is 1024, and the maximum number of secure MAC addresses supported for the switch system is 1024. When the limit is reached, all new MAC addresses are treated as authentication failures.

Example

```
SSE-G2252(config-if)#network-access max-mac-count 5
SSE-G2252(config-if)#
```

network-access mode mac-authentication

Use this command to enable network access authentication on a port. Use the **no** form of this command to disable network access authentication.

Syntax

[**no**] **network-access mode mac-authentication**

Default Setting

Disabled

Command Mode

Interface Configuration

Command Usage

- When enabled on a port, the authentication process sends a Password Authentication Protocol (PAP) request to a configured RADIUS server. The user name and password are both equal to the MAC address being authenticated.
- On the RADIUS server, PAP user name and passwords must be configured in the MAC address format XX-XX-XX-XX-XX-XX (all in upper case).
- Authenticated MAC addresses are stored as dynamic entries in the switch secure MAC address table and are removed when the aging time expires. The maximum number of secure MAC addresses supported for the switch system is 1024.
- Configured static MAC addresses are added to the secure address table when seen on a switch port. Static addresses are treated as authenticated without sending a request to a RADIUS server.
- MAC authentication, 802.1X, and port security cannot be configured together on the same port. Only one security mechanism can be applied.
- MAC authentication cannot be configured on trunk ports.
- When port status changes to down, all MAC addresses are cleared from the secure MAC address table. Static VLAN assignments are not restored.
- The RADIUS server may optionally return a VLAN identifier list. VLAN identifier list is carried in the "Tunnel-Private-Group-ID" attribute. The VLAN list can contain multiple VLAN identifiers in the format "1u,2t," where "u" indicates untagged VLAN and "t" tagged VLAN. The "Tunnel-Type" attribute should be set to "VLAN," and the "Tunnel-Medium-Type" attribute set to "802."

Example

```
SSE-G2252(config-if)#network-access mode mac-authentication
SSE-G2252(config-if)#
```

network-access port-mac-filter

Use this command to enable the specified MAC address filter. Use the **no** form of this command to disable the specified MAC address filter.

Syntax

network-access port-mac-filter *filter-id*

no network-access port-mac-filter

filter-id - Specifies a MAC address filter table. (Range: 1-64)

Default Setting

None

Command Mode

Interface Configuration

Command Mode

- Entries in the MAC address filter table can be configured with the network-access mac-filter command.
- Only one filter table can be assigned to a port.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#network-access port-mac-filter 1
SSE-G2252(config-if)#
```

mac-authentication intrusion-action

Use this command to configure the port response to a host MAC authentication failure. Use the **no** form of this command to restore the default.

Syntax

mac-authentication intrusion-action {**block traffic** | **pass traffic**}

no mac-authentication intrusion-action

Default Setting

Block Traffic

Command Mode

Interface Con figuration

Example

```
SSE-G2252(config-if)#mac-authentication intrusion-action block-traffic
SSE-G2252(config-if)#
```

mac-authentication max-mac-count

Use this command to set the maximum number of MAC addresses that can be authenticated on a port via MAC authentication. Use the **no** form of this command to restore the default.

Syntax

mac-authentication max-mac-count *count*

no mac-authentication max-mac-count

count - The maximum number of MAC-authenticated MAC addresses allowed. (Range: 1-1024)

Default Setting

1024

Command Mode

Interface Configuration

Example

```
SSE-G2252(config-if)#mac-authentication max-mac-count 32
SSE-G2252(config-if)#
```

clear network-access

Use this command to clear entries from the secure MAC addresses table.

Syntax

clear network-access mac-address-table [**static** | **dynamic**]
[**address** *mac-address*] [**interface** *interface*]

static - Specifies static address entries.

dynamic - Specifies dynamic address entries.

mac-address - Specifies a MAC address entry. (Format: xx-xx-xx-xx-xx-xx)

interface - Specifies a port interface.

ethernet *unit*/*port*

unit - This is unit 1.

port - Port number. (Range: 1-52)

Default Setting

None

Command Mode

Privileged Exec

Example

```
Console#clear network-access mac-address-table interface ethernet 1/1
Console#
```

show network-access

Use this command to display the MAC authentication settings for port interfaces.

Syntax

show network-access [**interface** *interface*]

interface - Specifies a port interface.

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Default Setting

Displays the settings for all interfaces.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show network-access interface ethernet 1/1
Global secure port information
Reauthentication Time                 : 1800
-----------------------------------------------
-----------------------------------------------
Port : 1/1
MAC Authentication                    : Disabled
MAC Authentication Intrusion action   : Block traffic
MAC Authentication Maximum MAC Counts : 1024
Maximum MAC Counts                    : 2048
Dynamic VLAN Assignment               : Enabled
Guest VLAN                            : Disabled
SSE-G2252#
```

show network-access mac-address-table

Use this command to display secure MAC address table entries.

Syntax

show network-access mac-address-table [**static** | **dynamic**]
[**address** *mac-address* [*mask*]] [**interface** *interface*] [**sort** {**address** | **interface**}]

static - Specifies static address entries.

dynamic - Specifies dynamic address entries.

mac-address - Specifies a MAC address entry. (Format: xx-xx-xx-xx-xx-xx)

mask - Specifies a MAC address bit mask for filtering displayed addresses.

interface - Specifies a port interface.

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

sort - Sorts displayed entries by either MAC address or interface.

Default Setting

Displays all filters.

Command Mode

Privileged Exec

Command Usage

When using a bit mask to filter displayed MAC addresses, a 1 means “care” and a 0 means “don't care”. For example, a MAC of 00-00-01-02-03-04 and mask FF-FF-FF-00-00-00 would result in all MACs in the range 00-00-01-00-00-00 to 00-00-01-FF-FF-FF to be displayed. All other MACs would be filtered out.

Example

```
SSE-G2252#show network-access mac-address-table
---- ----------------- --------------- ---------
Port MAC-Address       RADIUS-Server   Attribute Time
---- ----------------- --------------- ---------
1/1  00-00-01-02-03-04 172.155.120.17  Static    00d06h32m50s
1/1  00-00-01-02-03-05 172.155.120.17  Dynamic   00d06h33m20s
1/1  00-00-01-02-03-06 172.155.120.17  Static    00d06h35m10s
1/3  00-00-01-02-03-07 172.155.120.17  Dynamic   00d06h34m20s

SSE-G2252#
```

show network-access mac-filter

Use this command to display information for entries in the MAC filter tables.

Syntax

show network-access mac-filter [*filter-id*]

filter-id - Specifies a MAC address filter table. (Range: 1-64)

Default Setting

Displays all filters.

Command Mode

Privileged Exec

Example

```
Console#show network-access mac-filter
Filter ID MAC Address       MAC Mask
--------- ----------------- -----------------
        1 00-00-01-02-03-08 FF-FF-FF-FF-FF-FF
Console#
```

25-3 Web Authentication

Web authentication allows stations to authenticate and access the network in situations where 802.1X or Network Access authentication are infeasible or impractical. The web authentication feature allows unauthenticated hosts to request and receive a DHCP assigned IP address and perform DNS queries. All other traffic, except for HTTP protocol traffic, is blocked. The switch intercepts HTTP protocol traffic and redirects it to a switch-generated web page that facilitates user name and password authentication via RADIUS. Once authentication is successful, the web browser is forwarded on to the originally requested web page. Successful authentication is valid for all hosts connected to the port.

NOTE: RADIUS authentication must be activated and configured for the web authentication feature to work properly (see Section 24-2: "Authentication Sequence" on page 24-4).

NOTE: Web authentication cannot be configured on trunk ports.

Table 25-5. Web Authentication

Command	Function	Mode
web-auth login-attempts	Defines the limit for failed web authentication login attempts	GC
web-auth quiet-period	Defines the amount of time to wait after the limit for failed login attempts is exceeded.	GC
web-auth session-timeout	Defines the amount of time a session remains valid	GC
web-auth system-auth-control	Enables web authentication globally for the switch	GC
web-auth	Enables web authentication for an interface	IC
web-auth re-authenticate (Port)	Ends all web authentication sessions on the port and forces the users to re-authenticate	PE
web-auth re-authenticate (IP)	Ends the web authentication session associated with the designated IP address and forces the user to re-authenticate	PE
show web-auth	Displays global web authentication parameters	PE
show web-auth interface	Displays interface-specific web authentication parameters and statistics	PE
show web-auth summary	Displays a summary of web authentication port parameters and statistics	PE

web-auth login-attempts

This command defines the limit for failed web authentication login attempts. After the limit is reached, the switch refuses further login attempts until the quiet time expires. Use the **no** form to restore the default.

Syntax

web-auth login-attempts *count*

no web-auth login-attempts

count - The limit of allowed failed login attempts. (Range: 1-3)

Default Setting

3 login attempts

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#web-auth login-attempts 2
SSE-G2252(config)#
```

web-auth quiet-period

This command defines the amount of time a host must wait after exceeding the limit for failed login attempts, before it may attempt web authentication again. Use the **no** form to restore the default.

Syntax

web-auth quiet-period *time*

no web-auth quiet period

time - The amount of time the host must wait before attempting authentication again. (Range: 1-180 seconds)

Default Setting

60 seconds

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#web-auth quiet-period 120
SSE-G2252(config)#
```

web-auth session-timeout

This command defines the amount of time a web-authentication session remains valid. When the session timeout has been reached, the host is logged off and must re-authenticate itself the next time data transmission takes place. Use the **no** form to restore the default.

Syntax

web-auth session-timeout *timeout*

no web-auth session timeout

timeout - The amount of time that an authenticated session remains valid. (Range: 300-3600 seconds, or 0 for disabled)

Default Setting

3600 seconds

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#web-auth session-timeout 1800
SSE-G2252(config)#
```

web-auth system-auth-control

This command globally enables web authentication for the switch. Use the **no** form to restore the default.

Syntax

[**no**] **web-auth system-auth-control**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

Both **web-auth system-auth-control** for the switch and web-auth for an interface must be enabled for the web authentication feature to be active.

Example

```
SSE-G2252(config)#web-auth system-auth-control
SSE-G2252(config)#
```

web-auth

This command enables web authentication for an interface. Use the no form to restore the default.

Syntax

[**no**] **web-auth**

Default Setting

Disabled

Command Mode

Interface Configuration

Command Usage

Both web-auth system-auth-control for the switch and **web-auth** for a port must be enabled for the web authentication feature to be active.

Example

```
SSE-G2252(config-if)#web-auth
SSE-G2252(config-if)#
```

web-auth re-authenticate (Port)

This command ends all web authentication sessions connected to the port and forces the users to re-authenticate.

Syntax

web-auth re-authenticate interface *interface*

interface - Specifies a port interface.

ethernet *unit*/*port*

unit - This is unit 1.

port - Port number. (Range: 1-52)

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#web-auth re-authenticate interface ethernet 1/2
Failed to reauth.
SSE-G2252#
```

web-auth re-authenticate (IP)

This command ends the web authentication session associated with the designated IP address and forces the user to re-authenticate.

Syntax

web-auth re-authenticate interface *interface ip*

interface - Specifies a port interface.

ethernet *unit*/*port*

unit - This is unit 1.

port - Port number. (Range: 1-52)

ip - IPv4 formatted IP address

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#web-auth re-authenticate interface ethernet 1/2 192.168.1.5
Failed to reauth port.
SSE-G2252#
```

show web-auth

This command displays global web authentication parameters.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show web-auth

Global Web-Auth Parameters

  System Auth Control      : Enabled
  Session Timeout          : 3600
  Quiet Period             : 60
  Max Login Attempts       : 3
SSE-G2252#
```

show web-auth interface

This command displays interface-specific web authentication parameters and statistics.

Syntax

show web-auth interface *interface*

interface - Specifies a port interface.

ethernet *unit*/*port*

unit - This is unit 1.

port - Port number. (Range: 1-52)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show web-auth interface ethernet 1/2
Web Auth Status      : Enabled

Host Summary

IP address      Web-Auth-State Remaining-Session-Time
--------------- -------------- ----------------------
1.1.1.1         Authenticated  295
1.1.1.2         Authenticated  111
SSE-G2252#
```

show web-auth summary

This command displays a summary of web authentication port parameters and statistics.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show web-auth summary

Global Web-Auth Parameters

  System Auth Control      : Enabled
Port       Status          Authenticated Host Count
----       ------          ------------------------
1/ 1       Disabled        0
1/ 2       Enabled         8
1/ 3       Disabled        0
1/ 4       Disabled        0
1/ 5       Disabled        0
.
.
.
```

25-4 DHCP Snooping

DHCP snooping allows a switch to protect a network from rogue DHCP servers or other devices which send port-related information to a DHCP server. This information can be useful in tracking an IP address back to a physical port. This section describes commands used to configure DHCP snooping.

Table 25-6. DHCP Snooping Commands

Command	Function	Mode
ip dhcp snooping	Enables DHCP snooping globally	GC
ip dhcp snooping database flash	Writes all dynamically learned snooping entries to flash memory	GC
ip dhcp snooping information option	Enables or disables DHCP Option 82 information relay	GC
ip dhcp snooping information policy	Sets the information option policy for DHCP client packets that include Option 82 information	GC
ip dhcp snooping verify mac-address	Verifies the client's hardware address stored in the DHCP packet against the source MAC address in the Ethernet header	GC
ip dhcp snooping vlan	Enables DHCP snooping on the specified VLAN	GC
ip dhcp snooping trust	Configures the specified interface as trusted	IC
clear ip dhcp snooping database flash	Removes all dynamically learned snooping entries from flash memory.	PE
show ip dhcp snooping	Shows the DHCP snooping configuration settings	PE
show ip dhcp snooping binding	Shows the DHCP snooping binding table entries	PE

ip dhcp snooping

This command enables DHCP snooping globally. Use the **no** form to restore the default setting.

Syntax

[**no**] **ip dhcp snooping**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- Network traffic may be disrupted when malicious DHCP messages are received from an outside source. DHCP snooping is used to filter DHCP messages received on an unsecure interface from outside the network or fire wall. When DHCP snooping is enabled globally by this command, and enabled on a VLAN interface by the ip dhcp snooping vlan command, DHCP messages received on an untrusted interface (as specified by the no ip dhcp snooping trust command) from a device not listed in the DHCP snooping table will be dropped.
- When enabled, DHCP messages entering an untrusted interface are filtered based upon dynamic entries learned via DHCP snooping.
- Table entries are only learned for trusted interfaces. Each entry includes a MAC address, IP address, lease time, VLAN identifier, and port identifier.
- When DHCP snooping is enabled, the rate limit for the number of DHCP messages that can be processed by the switch is 100 packets per second. Any DHCP packets in excess of this limit are dropped.
- Filtering rules are implemented as follows:
  - If the global DHCP snooping is disabled, all DHCP packets are forwarded.
  - If DHCP snooping is enabled globally, and also enabled on the VLAN where the DHCP packet is received, all DHCP packets are forwarded for a *trusted* port. If the received packet is a DHCP ACK message, a dynamic DHCP snooping entry is also added to the binding table.
  - If DHCP snooping is enabled globally, and also enabled on the VLAN where the DHCP packet is received, but the port is *not trusted*, it is processed as follows:
    - If the DHCP packet is a reply packet from a DHCP server (including OFFER, ACK or NAK messages), the packet is dropped.
    - If the DHCP packet is from a client, such as a DECLINE or RELEASE message, the switch forwards the packet only if the corresponding entry is found in the binding table.
    - If the DHCP packet is from client, such as a DISCOVER, REQUEST, INFORM, DECLINE or RELEASE message, the packet is forwarded if MAC address verification is disabled (as specified by the ip dhcp snooping verify mac-address command). However, if MAC address verification is enabled, then the packet will only be forwarded if the client's hardware address stored in the DHCP packet is the same as the source MAC address in the Ethernet header.
    - If the DHCP packet is not a recognizable type, it is dropped.
  - If a DHCP packet from a client passes the filtering criteria above, it will only be forwarded to trusted ports in the same VLAN.
  - If a DHCP packet is from server is received on a trusted port, it will be forwarded to both trusted and untrusted ports in the same VLAN.

- If the DHCP snooping is globally disabled, all dynamic bindings are removed from the binding table.
- *Additional considerations when the switch itself is a DHCP client* – The port(s) through which the switch submits a client request to the DHCP server must be configured as trusted (using the ip dhcp snooping trust command). Note that the switch will not add a dynamic entry for itself to the binding table when it receives an ACK message from a DHCP server. Also, when the switch sends out DHCP client packets for itself, no filtering takes place. However, when the switch receives any messages from a DHCP server, any packets received from untrusted ports are dropped.

Example

This example enables DHCP snooping globally for the switch.

```
SSE-G2252(config)#ip dhcp snooping
SSE-G2252(config)#
```

Related Commands

"ip dhcp snooping vlan" on page 25-34

"ip dhcp snooping trust" on page 25-35

ip dhcp snooping database flash

This command writes all dynamically learned snooping entries to flash memory.

Command Mode

Privileged Exec

Command Usage

This command can be used to store the currently learned dynamic DHCP snooping entries to flash memory. These entries will be restored to the snooping table when the switch is reset. However, note that the lease time shown for a dynamic entry that has been restored from flash memory will no longer be valid.

Example

```
SSE-G2252(config)#ip dhcp snooping database flash
SSE-G2252(config)#
```

ip dhcp snooping information option

This command enables the DHCP Option 82 information relay for the switch. Use the **no** form to disable this function.

Syntax

[**no**] **ip dhcp snooping information option**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- DHCP provides a relay mechanism for sending information about the switch and its DHCP clients to the DHCP server. Known as DHCP Option 82, it allows compatible DHCP servers to use the information when assigning IP addresses, or to set other services or policies for clients.
- When the DHCP Snooping Information Option is enabled, the requesting client (or an intermediate relay agent that has used the information fields to describe itself) can be identified in the DHCP request packets forwarded by the switch and in reply packets sent back from the DHCP server by the switch port to which they are connected rather than just their MAC address. DHCP client-server exchange messages are then forwarded directly between the server and client without having to flood them to the entire VLAN.
- DHCP snooping must be enabled on the switch for the DHCP Option 82 information to be inserted into packets.
- Use the **ip dhcp snooping information option** command to specify how to handle DHCP client request packets which already contain Option 82 information.

Example

This example enables the DHCP Snooping Information Option.

```
SSE-G2252(config)#ip dhcp snooping information option
SSE-G2252(config)#
```

ip dhcp snooping information policy

This command sets the DHCP snooping information option policy for DHCP client packets that include Option 82 information.

Syntax

ip dhcp snooping information policy {**drop** | **keep** | **replace**}

drop - Drops the client's request packet instead of relaying it.

keep - Retains the Option 82 information in the client request, and forwards the packets to trusted ports.

replace - Replaces the Option 82 information circuit-id and remote-id fields in the client's request with information about the relay agent itself, inserts the relay agent's address (when DHCP snooping is enabled), and forwards the packets to trusted ports.

Default Setting

replace

Command Mode

Global Configuration

Command Usage

When the switch receives DHCP packets from clients that already include DHCP Option 82 information, the switch can be configured to set the action policy for these packets. The switch can either drop the DHCP packets, keep the existing information, or replace it with the switch's relay information.

Example

```
SSE-G2252(config)#ip dhcp snooping information policy drop
SSE-G2252(config)#
```

ip dhcp snooping verify mac-address

This command verifies the client's hardware address stored in the DHCP packet against the source MAC address in the Ethernet header. Use the **no** form to disable this function.

Syntax

[**no**] **ip dhcp binding verify mac-address**

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

If MAC address verification is enabled, and the source MAC address in the Ethernet header of the packet is not same as the client's hardware address in the DHCP packet, the packet is dropped.

Example

This example enables MAC address verification.

```
SSE-G2252(config)#ip dhcp snooping verify mac-address
SSE-G2252(config)#
```

Related Commands

"ip dhcp snooping" on page 25-28

"ip dhcp snooping vlan" on page 25-34

"ip dhcp snooping trust" on page 25-35

ip dhcp snooping vlan

This command enables DHCP snooping on the specified VLAN. Use the **no** form to restore the default setting.

Syntax

[**no**] **ip dhcp snooping vlan** *vlan-id*

vlan-id - ID of a configured VLAN (Range: 1-4093)

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- When DHCP snooping enabled globally using the ip dhcp snooping command, and enabled on a VLAN with this command, DHCP packet filtering will be performed on any untrusted ports within the VLAN as specified by the ip dhcp snooping trust command.
- When the DHCP snooping is globally disabled, DHCP snooping can still be configured for specific VLANs, but the changes will not take effect until DHCP snooping is globally re-enabled.
- When DHCP snooping is globally enabled, configuration changes for specific VLANs have the following effects:
  - If DHCP snooping is disabled on a VLAN, all dynamic bindings learned for this VLAN are removed from the binding table.

Example

This example enables DHCP snooping for VLAN 1.

```
SSE-G2252(config)#ip dhcp snooping vlan 1
SSE-G2252(config)#
```

Related Commands

"ip dhcp snooping" on page 25-28

"ip dhcp snooping trust" on page 25-35

ip dhcp snooping trust

This command configures the specified interface as trusted. Use the **no** form to restore the default setting.

Syntax

[**no**] **ip dhcp snooping trust**

Default Setting

All interfaces are untrusted

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- A trusted interface is an interface that is configured to receive only messages from within the network. An untrusted interface is an interface that is configured to receive messages from outside the network or fire wall.
- Set all ports connected to DHCP servers within the local network or fire wall to trusted, and all other ports outside the local network or fire wall to untrusted.
- When DHCP snooping ia enabled globally using the ip dhcp snooping command, and enabled on a VLAN with ip dhcp snooping vlan command, DHCP packet filtering will be performed on any untrusted ports within the VLAN according to the default status, or as specifically configured for an interface with the **no ip dhcp snooping trust** command.
- When an untrusted port is changed to a trusted port, all the dynamic DHCP snooping bindings associated with this port are removed.
- *Additional considerations when the switch itself is a DHCP client* – The port(s) through which it submits a client request to the DHCP server must be configured as trusted.

Example

This example sets port 5 to untrusted.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#no ip dhcp snooping trust
SSE-G2252(config-if)#
```

Related Commands

"ip dhcp snooping" on page 25-28

"ip dhcp snooping vlan" on page 25-34

clear ip dhcp snooping database flash

This command removes all dynamically learned snooping entries from flash memory.

Command Mode

Privileged Exec

Example

```
SSE-G2252(config)#ip dhcp snooping database flash
SSE-G2252(config)#
```

show ip dhcp snooping

This command shows the DHCP snooping configuration settings.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip dhcp snooping
Global DHCP Snooping status: disable
DHCP Snooping Information Option Status: disable
DHCP Snooping Information Policy: replace
DHCP Snooping is configured on the following VLANs:
1
Verify Source Mac-Address: enable
Interface           Trusted
----------          ----------
Eth 1/1             No
Eth 1/2             No
Eth 1/3             No
Eth 1/4             No
Eth 1/5             Yes
.
.
.
```

show ip dhcp snooping binding

This command shows the DHCP snooping binding table entries.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip dhcp snooping binding
MacAddress        IpAddress       Lease(sec) Type                VLAN
Interface
----------------- --------------- ---------- ------------------- ----
------
11-22-33-44-55-66 192.168.0.99            0 Dynamic-DHCPSNP      1 Eth 1/5
SSE-G2252#
```

25-5 IP Source Guard

IP Source Guard is a security feature that filters IP traffic on network interfaces based on manually configured entries in the IP Source Guard table, or dynamic entries in the DHCP Snooping table when enabled (see Section 25-4: "DHCP Snooping" on page 25-28). IP source guard can be used to prevent traffic attacks caused when a host tries to use the IP address of a neighbor to access the network. This section describes commands used to configure IP Source Guard.

Table 25-7. IP Source Guard Commands

Command	Function	Mode
ip source-guard binding	Adds a static address to the source-guard binding table	GC
ip source-guard	Configures the switch to filter inbound traffic based on source IP address, or source IP address and corresponding MAC address	IC
ip source-guard max-binding	Sets the maximum number of entries that can be bound to an interface	IC
show ip source-guard	Shows whether source guard is enabled or disabled on each interface	PE
show ip source-guard binding	Shows the source guard binding table	PE

ip source-guard binding

This command adds a static address to the source-guard binding table. Use the **no** form to remove a static entry.

Syntax

ip source-guard binding *mac-address* **vlan** *vlan-id ip-address* **interface ethernet** *unit/port*

no ip source-guard binding *mac-address* **vlan** *vlan-id*

mac-address - A valid unicast MAC address.

vlan-id - ID of a configured VLAN (Range: 1-4093)

ip-address - A valid unicast IP address, including classful types A, B or C.

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Default Setting

No configured entries

Command Mode

Global Configuration

Command Usage

- Table entries include a MAC address, IP address, lease time, entry type (Static-IP-SG-Binding, Dynamic-DHCP-Binding), VLAN identifier, and port identifier.
- All static entries are configured with an infinite lease time, which is indicated with a value of zero by the show ip source-guard command ("show ip source-guard" on page 25-42).
- When source guard is enabled, traffic is filtered based upon dynamic entries learned via DHCP snooping, or static addresses configured in the source guard binding table with this command.
- Static bindings are processed as follows:
  - If there is no entry with same VLAN ID and MAC address, a new entry is added to binding table using the type of static IP source guard binding.
  - If there is an entry with same VLAN ID and MAC address, and the type of entry is static IP source guard binding, then the new entry will replace the old one.
  - If there is an entry with same VLAN ID and MAC address, and the type of the entry is dynamic DHCP snooping binding, then the new entry will replace the old one and the entry type will be changed to static IP source guard binding.

Example

This example configures a static source-guard binding on port 5.

```
SSE-G2252(config)#ip source-guard binding 11-22-33-44-55-66 vlan 1
192.168.0.99 interface ethernet 1/5
SSE-G2252(config-if)#
```

Related Commands

"ip source-guard" on page 25-39

"ip dhcp snooping" on page 25-28

"ip dhcp snooping vlan" on page 25-34

ip source-guard

This command configures the switch to filter inbound traffic based source IP address, or source IP address and corresponding MAC address. Use the **no** form to disable this function.

Syntax

ip source-guard {**sip** | **sip-mac**}

no ip source-guard

sip - Filters traffic based on IP addresses stored in the binding table.

sip-mac - Filters traffic based on IP addresses and corresponding MAC addresses stored in the binding table.

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Source guard is used to filter traffic on an insecure port which receives messages from outside the network or fire wall, and therefore may be subject to traffic attacks caused by a host trying to use the IP address of a neighbor.
- Setting source guard mode to “sip” or “sip-mac” enables this function on the selected port. Use the “sip” option to check the VLAN ID, source IP address, and port number against all entries in the binding table. Use the “sip-mac” option to check these same parameters, plus the source MAC address. Use the **no ip source guard** command to disable this function on the selected port.

- When enabled, traffic is filtered based upon dynamic entries learned via DHCP snooping, or static addresses configured in the source guard binding table.
- Table entries include a MAC address, IP address, lease time, entry type (Static-IP-SG-Binding, Dynamic-DHCP-Binding, VLAN identifier, and port identifier.
- Static addresses entered in the source guard binding table with the ip source-guard binding command ("ip source-guard binding" on page 25-38) are automatically configured with an infinite lease time. Dynamic entries learned via DHCP snooping are configured by the DHCP server itself.
- If the IP source guard is enabled, an inbound packet's IP address (sip option) or both its IP address and corresponding MAC address (sip-mac option) will be checked against the binding table. If no matching entry is found, the packet will be dropped.
- Filtering rules are implemented as follows:
  - If DHCP snooping is disabled (see "ip dhcp snooping" on page 25-28), IP source guard will check the VLAN ID, source IP address, port number, and source MAC address (for the sip-mac option). If a matching entry is found in the binding table and the entry type is static IP source guard binding, the packet will be forwarded.
  - If the DHCP snooping is enabled, IP source guard will check the VLAN ID, source IP address, port number, and source MAC address (for the sip-mac option). If a matching entry is found in the binding table and the entry type is static IP source guard binding, or dynamic DHCP snooping binding, the packet will be forwarded.
  - If IP source guard if enabled on an interface for which IP source bindings (dynamically learned via DHCP snooping or manually configured) are not yet configured, the switch will drop all IP traffic on that port, except for DHCP packets.
  - Only unicast addresses are accepted for static bindings.

Example

This example enables IP source guard on port 5.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#ip source-guard sip
SSE-G2252(config-if)#
```

Related Commands

"ip source-guard binding" on page 25-38

"ip dhcp snooping" on page 25-28

"ip dhcp snooping vlan" on page 25-34

ip source-guard max-binding

This command sets the maximum number of entries that can be bound to an interface. Use the **no** form to restore the default setting.

Syntax

ip source-guard max-binding *number*

no ip source-guard max-binding

number - The maximum number of IP addresses that can be mapped to an interface in the binding table. (Range: 1-5)

Default Setting

5

Command Mode

Interface Configuration (Ethernet)

Command Usage

- This command sets the maximum number of address entries that can be mapped to an interface in the binding table, including both dynamic entries discovered by DHCP snooping and static entries set by the ip source-guard command.

Example

This example sets the maximum number of allowed entries in the binding table for port 5 to one entry.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#ip source-guard max-binding 1
SSE-G2252(config-if)#
```

show ip source-guard

This command shows whether source guard is enabled or disabled on each interface.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip source-guard
Interface   Filter-type   Max-binding
---------   -----------   -----------
Eth 1/1     DISABLED                5
Eth 1/2     DISABLED                5
Eth 1/3     DISABLED                5
Eth 1/4     DISABLED                5
Eth 1/5     SIP                     1
Eth 1/6     DISABLED                5
.
.
.
```

show ip source-guard binding

This command shows the source guard binding table.

Syntax

show ip source-guard binding [**dhcp-snooping** | **static**]

dhcp-snooping - Shows dynamic entries configured with DHCP Snooping commands (see DHCP Snooping)

static - Shows static entries configured with the ip source-guard binding command (see ip source-guard binding).

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip source-guard binding
MacAddress        IpAddress       Lease(sec) Type                VLAN
Interface
----------------- --------------- ---------- ---
11-22-33-44-55-66 192.168.0.99            0 Static                 1 Eth
1/5
SSE-G2252#
```

25-6 ARP Inspection

ARP Inspection validates the MAC-to-IP address bindings in Address Resolution Protocol (ARP) packets. It protects against ARP traffic with invalid address bindings, which forms the basis for certain “man-in-the-middle” attacks. This is accomplished by intercepting all ARP requests and responses and verifying each of these packets before the local ARP cache is updated or the packet is forwarded to the appropriate destination, dropping any invalid ARP packets.

ARP Inspection determines the validity of an ARP packet based on valid IP-to-MAC address bindings stored in a trusted database – the DHCP snooping binding database. ARP Inspection can also validate ARP packets against user-configured ARP access control lists (ACLs) for hosts with statically configured IP addresses.

This section describes commands used to configure ARP Inspection.

Table 25-8. ARP Inspection Commands

Command	Function	Mode
ip arp inspection	Enables ARP Inspection globally on the switch	GC
ip arp inspection filter	Specifies an ARP ACL to apply to one or more VLANs	GC
ip arp inspection log-buffer logs	Sets the maximum number of entries saved in a log message, and the rate at these messages are sent	GC
ip arp inspection validate	Specifies additional validation of address components in an ARP packet	GC
ip arp inspection vlan	Enables ARP Inspection for a specified VLAN or range of VLANs	GC
ip arp inspection limit	Sets a rate limit for the ARP packets received on a port	IC
ip arp inspection trust	Sets a port as trusted, and thus exempted from ARP Inspection	IC
show ip arp inspection configuration	Displays the global configuration settings for ARP Inspection	PE
show ip arp inspection interface	Shows the trust status and inspection rate limit for ports	PE
show ip arp inspection log	Shows information about entries stored in the log, including the associated VLAN, port, and address components	PE
show ip arp inspection statistics	Shows statistics about the number of ARP packets processed, or dropped for various reasons	PE
show ip arp inspection vlan	Shows configuration setting for VLANs, including ARP Inspection status, the ARP ACL name, and if the DHCP Snooping database is used after ACL validation is completed	PE

ip arp inspection

This command enables ARP Inspection globally on the switch. Use the **no** form to disable this function.

Syntax

[**no**] **ip arp inspection**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- When ARP Inspection is enabled globally with this command, it becomes active only on those VLANs where it has been enabled with the ip arp inspection vlan command.
- When ARP Inspection is enabled globally and enabled on selected VLANs, all ARP request and reply packets on those VLANs are redirected to the CPU and their switching is handled by the ARP Inspection engine.
- When ARP Inspection is disabled globally, it becomes inactive for all VLANs, including those where ARP Inspection is enabled.
- When ARP Inspection is disabled, all ARP request and reply packets bypass the ARP Inspection engine and their manner of switching matches that of all other packets.
- Disabling and then re-enabling global ARP Inspection will not affect the ARP Inspection configuration for any VLANs.
- When ARP Inspection is disabled globally, it is still possible to configure ARP Inspection for individual VLANs. These configuration changes will only become active after ARP Inspection is globally enabled again.

Example

```
SSE-G2252(config)#ip arp inspection
SSE-G2252(config)#
```

ip arp inspection filter

This command specifies an ARP ACL to apply to one or more VLANs. Use the **no** form to remove an ACL binding.

Syntax

ip arp inspection filter *arp-acl-name* **vlan** {*vlan-id* | *vlan-range*} [**static**]

arp-acl-name - Name of an ARP ACL. (Maximum length: 16 characters)

vlan-id - VLAN ID. (Range: 1-4093)

vlan-range - A consecutive range of VLANs indicated by the use a hyphen, or a random group of VLANs with each entry separated by a comma.

static - ARP packets are only validated against the specified ACL, address bindings in the DHCP snooping database is not checked.

Default Setting

ARP ACLs are not bound to any VLAN

Static mode is not enabled

Command Mode

Global Configuration

Command Usage

- ARP ACLs are configured with the commands described on page 14-56.
- If static mode is enabled, the switch compares ARP packets to the specified ARP ACLs. Packets matching an IP-to-MAC address binding in a permit or deny rule are processed accordingly. Packets not matching any of the ACL rules are dropped. Address bindings in the DHCP snooping database are not checked.
- If static mode is not enabled, packets are first validated against the specified ARP ACL. Packets matching a deny rule are dropped. All remaining packets are validated against the address bindings in the DHCP snooping database.

Example

```
SSE-G2252(config)#ip arp inspection filter sales vlan 1
SSE-G2252(config)#
```

ip arp inspection log-buffer logs

This command sets the maximum number of entries saved in a log message, and the rate at which these messages are sent. Use the **no** form to restore the default settings.

Syntax

ip arp inspection log-buffer logs *message-number* **interval** *seconds*

no ip arp inspection log-buffer logs

message-number - The maximum number of entries saved in a log message. (Range: 0-256, where 0 means no events are saved)

seconds - The interval at which log messages are sent. (Range: 0-86400)

Default Setting

Message Number: 5

Interval: 1 second

Command Mode

Global Configuration

Command Usage

- ARP Inspection must be enabled with the ip arp inspection command before this command will be accepted by the switch.
- By default, logging is active for ARP Inspection, and cannot be disabled.
- When the switch drops a packet, it places an entry in the log buffer. Each entry contains flow information, such as the receiving VLAN, the port number, the source and destination IP addresses, and the source and destination MAC addresses.
- If multiple, identical invalid ARP packets are received consecutively on the same VLAN, then the logging facility will only generate one entry in the log buffer and one corresponding system message.
- The maximum number of entries that can be stored in the log buffer is determined by the *message-number* parameter. If the log buffer fills up before a message is sent, the oldest entry will be replaced with the newest one.
- The switch generates a system message on a rate-controlled basis determined by the *seconds* values. After the system message is generated, all entries are cleared from the log buffer.

Example

```
SSE-G2252(config)#ip arp inspection log-buffer logs 1 interval 10
SSE-G2252(config)#
```

ip arp inspection validate

This command specifies additional validation of address components in an ARP packet. Use the **no** form to restore the default setting.

Syntax

ip arp inspection validate {**dst-mac** [**ip**] [**src-mac**] |
ip [**src-mac**] | **src-mac**}

no ip arp inspection validate

dst-mac - Checks the destination MAC address in the Ethernet header against the target MAC address in the ARP body. This check is performed for ARP responses. When enabled, packets with different MAC addresses are classified as invalid and are dropped.

ip - Checks the ARP body for invalid and unexpected IP addresses. Addresses include 0.0.0.0, 255.255.255.255, and all IP multicast addresses. Sender IP addresses are checked in all ARP requests and responses, while target IP addresses are checked only in ARP responses.

src-mac - Checks the source MAC address in the Ethernet header against the sender MAC address in the ARP body. This check is performed on both ARP requests and responses. When enabled, packets with different MAC addresses are classified as invalid and are dropped.

Default Setting

No additional validation is performed

Command Mode

Global Configuration

Command Usage

By default, ARP Inspection only checks the IP-to-MAC address bindings specified in an ARP ACL or in the DHCP Snooping database.

Example

```
SSE-G2252(config)#ip arp inspection validate dst-mac
SSE-G2252(config)#
```

ip arp inspection vlan

This command enables ARP Inspection for a specified VLAN or range of VLANs. Use the **no** form to disable this function.

Syntax

[**no**] **ip arp inspection vlan** {*vlan-id* | *vlan-range*}

vlan-id - VLAN ID. (Range: 1-4093)

vlan-range - A consecutive range of VLANs indicated by the use a hyphen, or a random group of VLANs with each entry separated by a comma.

Default Setting

Disabled on all VLANs

Command Mode

Global Configuration

Command Usage

- When ARP Inspection is enabled globally with the ip arp inspection command, it becomes active only on those VLANs where it has been enabled with this command.
- When ARP Inspection is enabled globally and enabled on selected VLANs, all ARP request and reply packets on those VLANs are redirected to the CPU and their switching is handled by the ARP Inspection engine.
- When ARP Inspection is disabled globally, it becomes inactive for all VLANs, including those where ARP Inspection is enabled.
- When ARP Inspection is disabled, all ARP request and reply packets bypass the ARP Inspection engine and their manner of switching matches that of all other packets.
- Disabling and then re-enabling global ARP Inspection will not affect the ARP Inspection configuration for any VLANs.
- When ARP Inspection is disabled globally, it is still possible to configure ARP Inspection for individual VLANs. These configuration changes will only become active after ARP Inspection is globally enabled again.

Example

```
SSE-G2252(config)#ip arp inspection vlan 1,2
SSE-G2252(config)#
```

ip arp inspection limit

This command sets a rate limit for the ARP packets received on a port. Use the **no** form to restore the default setting.

Syntax

ip arp inspection limit {**rate** *pps* | **none**}

no ip arp inspection limit

pps - The maximum number of ARP packets that can be processed by the CPU per second. (Range: 0-2048, where 0 means that no ARP packets can be forwarded)

none - There is no limit on the number of ARP packets that can be processed by the CPU.

Default Setting

15

Command Mode

Interface Configuration (Port)

Command Usage

- This command only applies to untrusted ports.
- When the rate of incoming ARP packets exceeds the configured limit, the switch drops all ARP packets in excess of the limit.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#ip arp inspection limit 150
SSE-G2252(config-if)#
```

ip arp inspection trust

This command sets a port as trusted, and thus exempted from ARP Inspection. Use the **no** form to restore the default setting.

Syntax

[**no**] **ip arp inspection trust**

Default Setting

Untrusted

Command Mode

Interface Configuration (Port)

Command Usage

Packets arriving on untrusted ports are subject to any configured ARP Inspection and additional validation checks. Packets arriving on trusted ports bypass all of these checks, and are forwarded according to normal switching rules.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#ip arp inspection trust
SSE-G2252(config-if)#
```

show ip arp inspection configuration

This command displays the global configuration settings for ARP Inspection.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip arp inspection configuration

ARP inspection global information:

Global IP ARP Inspection status : disabled
Log Message Interval            : 10 s
Log Message Number              : 1
Need Additional Validation(s)   : Yes
Additional Validation Type      : Destination MAC address
SSE-G2252#
```

show ip arp inspection interface

This command shows the trust status and ARP Inspection rate limit for ports.

Syntax

show ip arp inspection interface [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip arp inspection interface ethernet 1/1

Port Number         Trust Status             Limit Rate (pps)
-------------   --------------------    ------------------------------
Eth 1/1             trusted                    150
SSE-G2252#
```

show ip arp inspection log

This command shows information about entries stored in the log, including the associated VLAN, port, and address components.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip arp inspection log
Total log entries number is 1

Num VLAN Port Src IP Address  Dst IP Address  Src MAC Address  Dst MAC
Address
--- ---- ---- --------------  --------------  ---------------
--------------
1   1     11  192.168.2.2     192.168.2.1     00-04-E2-A0-E2-7C
FF-FF-FF-FF-FF-FF
SSE-G2252#
```

show ip arp inspection statistics

This command shows statistics about the number of ARP packets processed, or dropped for various reasons.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip arp inspection log
Total log entries number is 1

Num VLAN Port Src IP Address  Dst IP Address  Src MAC Address  Dst MAC
Address
--- ---- ---- --------------  --------------  ---------------  -----------

SSE-G2252#show ip arp inspection statistics

ARP packets received before rate limit                              : 150
ARP packets dropped due to rate limt                                 : 5
Total ARP packets processed by ARP Inspection                       : 150
ARP packets dropped by additional validation (source MAC address)     : 0
ARP packets dropped by additional validation (destination MAC address): 0
ARP packets dropped by additional validation (IP address)             : 0
ARP packets dropped by ARP ACLs                                       : 0
ARP packets dropped by DHCP snooping                                  : 0

SSE-G2252#
```

show ip arp inspection vlan

This command shows the configuration settings for VLANs, including ARP Inspection status, the ARP ACL name, and if the DHCP Snooping database is used after ARP ACL validation is completed.

Syntax

show ip arp inspection vlan [*vlan-id* | *vlan-range*]

vlan-id - VLAN ID. (Range: 1-4093)

vlan-range - A consecutive range of VLANs indicated by the use a hyphen, or a random group of VLANs with each entry separated by a comma.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip arp inspection vlan 1

VLAN ID     DAI Status             ACL Name             ACL Status
--------   ---------------    --------------------    --------------------
1           disabled               sales               static
SSE-G2252#
```

Notes

Chapter 26
Access Control Lists

Access Control Lists (ACL) provide packet filtering for IPv4 frames (based on address, protocol, Layer 4 protocol port number or TCP control code), IPv6 frames (based on address, DSCP traffic class, next header typeor any frames (based on MAC address or Ethernet type). To filter packets, first create an access list, add the required rules, and then bind the list to a specific port. This section describes the Access Control List commands.

Table 26-1. Access Control List Commands

Command Group	Function
IPv4 ACLs	Configures ACLs based on IPv4 addresses, TCP/UDP port number, protocol type, and TCP control code
IPv6 ACLs	Configures ACLs based on IPv6 addresses or DSCP traffic class
MAC ACLs	Configures ACLs based on hardware addresses, packet format, and Ethernet type
ARP ACLs	Configures ACLs based on ARP messages addresses
ACL Information	Displays ACLs and associated rules; shows ACLs assigned to each port

26-1 IPv4 ACLs

The commands in this section configure ACLs based on IPv4 addresses, TCP/UDP port number, protocol type, and TCP control code. To configure IPv4 ACLs, first create an access list containing the required permit or deny rules, and then bind the access list to one or more ports.

Table 26-2. IPv4 ACL Commands

Command	Function	Mode
access-list ip	Creates an IP ACL and enters configuration mode for standard or extended IPv4 ACLs	GC
permit, deny, redirect-to (Standard IP ACL)	Filters packets matching a specified source IPv4 address	IPv4-STD-ACL
permit, deny, redirect-to (Extended IPv4 ACL)	Filters packets meeting the specified criteria, including source and destination IPv4 address, TCP/UDP port number, protocol type, and TCP control code	IPv4-EXT-ACL
ip access-group	Binds an IPv4 ACL to a port	IC
show ip access-group	Shows port assignments for IPv4 ACLs	PE
show ip access-list	Displays the rules for configured IPv4 ACLs	PE

access-list ip

This command adds an IP access list and enters configuration mode for standard or extended IPv4 ACLs. Use the **no** form to remove the specified ACL.

Syntax

[**no**] **access-list ip** {**standard** | **extended**} *acl-name*

standard – Specifies an ACL that filters packets based on the source IP address.

extended – Specifies an ACL that filters packets based on the source or destination IP address, and other more specific criteria.

acl-name – Name of the ACL. (Maximum length: 32 characters, no spaces or other special characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- When you create a new ACL or enter configuration mode for an existing ACL, use the **permit** or **deny** command to add new rules to the bottom of the list.
- To remove a rule, use the **no permit** or **no deny** command followed by the exact text of a previously configured rule.
- An ACL can contain up to 128 rules.

Example

```
SSE-G2252(config)#access-list ip standard david
SSE-G2252(config-std-acl)#
```

Related Commands

"permit, deny, redirect-to (Standard IP ACL)" on page 26-3

"ip access-group" on page 26-8

"show ip access-group" on page 26-8

permit, deny, redirect-to (Standard IP ACL)

This command adds a rule to a Standard IPv4 ACL. The rule sets a filter condition for packets emanating from the specified source. Use the **no** form to remove a rule.

Syntax

{**permit** | **deny** | **redirect-to** *interface*}
{**any** | *source bitmask* | **host** *source*}
[**time-range** *time-range-name*]

no {**permit** | **deny** | **redirect-to** *interface*}
{**any** | *source bitmask* | **host** *source*}

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

any – Any source IP address.

source – Source IP address.

bitmask – Decimal number representing the address bits to match.

host – Keyword followed by a specific IP address.

time-range-name - Name of the time range. (Range: 1-30 characters)

Default Setting

None

Command Mode

Standard IPv4 ACL

Command Usage

- New rules are appended to the end of the list.
- Address bit masks are similar to a subnet mask, containing four integers from 0 to 255, each separated by a period. The binary mask uses 1 bits to indicate “match” and 0 bits to indicate “ignore.” The bitmask is bitwise ANDed with the specified source IP address, and then compared with the address for each IP packet entering the port(s) to which this ACL has been assigned.

Example

This example configures one permit rule for the specific address 10.1.1.21 and another rule for the address range 168.92.16.x – 168.92.31.x using a bitmask.

```
SSE-G2252(config-std-acl)#permit host 10.1.1.21
SSE-G2252(config-std-acl)#permit 168.92.16.0 255.255.240.0
SSE-G2252(config-std-acl)#
```

Related Commands

"access-list ip" on page 26-2

"time-range" on page 21-60

permit, deny, redirect-to (Extended IPv4 ACL)

This command adds a rule to an Extended IPv4 ACL. The rule sets a filter condition for packets with specific source or destination IP addresses, protocol types, source or destination protocol ports, or TCP control codes. Use the **no** form to remove a rule.

Syntax

{**permit** | **deny** | **redirect-to** *interface*} [*protocol-number* | **udp**]
{**any** | *source address-bitmask* | **host** *source*}
{**any** | *destination address-bitmask* | **host** *destination*}
[**precedence** *precedence*] [**tos** *tos*] [**dscp** *dscp*]
[**source**-port *sport* [*bitmask*]]
[**destination**-port *dport* [*port-bitmask*]]
[**time-range** *time-range-name*]

no {**permit** | **deny** | **redirect-to** *interface*} [*protocol-number* | **udp**]
{**any** | *source address-bitmask* | **host** *source*}
{**any** | *destination address-bitmask* | **host** *destination*}
[**precedence** *precedence*] [**tos** *tos*] [**dscp** *dscp*]
[**source**-port *sport* [*bitmask*]]
[**destination**-port *dport* [*port-bitmask*]]

{**permit** | **deny** | **redirect-to** *interface*} **tcp**
{**any** | *source address-bitmask* | **host** *source*}
{**any** | *destination address-bitmask* | **host** *destination*}
[**precedence** *precedence*] [**tos** *tos*] [**dscp** *dscp*]
[**source-port** *sport* [*bitmask*]]
[**destination-port** *dport* [*port-bitmask*]]
[**control-flag** *control-flags flag-bitmask*]
[**time-range** *time-range-name*]

no {**permit** | **deny** | **redirect-to** *interface*} **tcp**
{**any** | *source address-bitmask* | **host** *source*}
{**any** | *destination address-bitmask* | **host** *destination*}
[**precedence** *precedence*] [**tos** *tos*] [**dscp** *dscp*]
[**source-port** *sport* [*bitmask*]]
[**destination-port** *dport* [*port-bitmask*]]
[**control-flag** *control-flags flag-bitmask*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

protocol-number – A specific protocol number. (Range: 0-255)

source – Source IP address.

destination – Destination IP address.

address-bitmask – Decimal number representing the address bits to match.

host – Keyword followed by a specific IP address.

precedence – IP precedence level. (Range: 0-7)

tos – Type of Service level. (Range: 0-15)

dscp – DSCP priority level. (Range: 0-63)

sport – Protocol[1] source port number. (Range: 0-65535)

dport – Protocol[1] destination port number. (Range: 0-65535)

port-bitmask – Decimal number representing the port bits to match. (Range: 0-65535)

control-flags – Decimal number (representing a bit string) that specifies flag bits in byte 14 of the TCP header. (Range: 0-63)

flag-bitmask – Decimal number representing the code bits to match.

time-range-name - Name of the time range. (Range: 1-30 characters)

Default Setting

None

Command Mode

Extended IPv4 ACL

1. Includes TCP, UDP or other protocol types.

Command Usage

- All new rules are appended to the end of the list.
- Address bit masks are similar to a subnet mask, containing four integers from 0 to 255, each separated by a period. The binary mask uses 1 bits to indicate "match" and 0 bits to indicate "ignore." The bit mask is bitwise ANDed with the specified source IP address, and then compared with the address for each IP packet entering the port(s) to which this ACL has been assigned.
- You can specify both Precedence and ToS in the same rule. However, if DSCP is used, then neither Precedence nor ToS can be specified.
- The control-code bitmask is a decimal number (representing an equivalent bit mask) that is applied to the control code. Enter a decimal number, where the equivalent binary bit "1" means to match a bit and "0" means to ignore a bit. The following bits may be specified:
  - 1 (fin) – Finish
  - 2 (syn) – Synchronize
  - 4 (rst) – Reset
  - 8 (psh) – Push
  - 16 (ack) – Acknowledgement
  - 32 (urg) – Urgent pointer

  For example, use the code value and mask below to catch packets with the following flags set:
  - SYN flag valid, use "control-code 2 2"
  - Both SYN and ACK valid, use "control-code 18 18"
  - SYN valid and ACK invalid, use "control-code 2 18"
- Due to a ASIC limitation, the switch only checks the leftmost six priority bits. This presents no problem when checking DSCP or IP Precedence bits, but limits the checking of ToS bits (underlined in the following example) to the leftmost three bits, ignoring the rightmost fourth bit.

  For example, if you configured an access list to deny packets with a ToS of 7 (00001110), the highlighted bit would be ignored, and the access list would drop packets with a ToS of both 6 and 7.

Table 26-3. Priority Bits Processed by Extended IPv4 ACL

DSCP							
Precedence			**ToS**				
7	6	5	4	3	2	1	0

Example

This example accepts any incoming packets if the source address is within subnet 10.7.1.x. For example, if the rule is matched; i.e., the rule (10.7.1.0 & 255.255.255.0) equals the masked address (10.7.1.2 & 255.255.255.0), the packet passes through.

```
SSE-G2252(config-ext-acl)#permit 10.7.1.1 255.255.255.0 any
SSE-G2252(config-ext-acl)#
```

This allows TCP packets from class C addresses 192.168.1.0 to any destination address when set for destination TCP port 80 (i.e., HTTP).

```
SSE-G2252(config-ext-acl)#permit 192.168.1.0 255.255.255.0 any
destination-port 80
SSE-G2252(config-ext-acl)#
```

This permits all TCP packets from class C addresses 192.168.1.0 with the TCP control code set to “SYN.”

```
SSE-G2252(config-ext-acl)#permit tcp 192.168.1.0 255.255.255.0 any
control-flag 2 2
SSE-G2252(config-ext-acl)#
```

Related Commands

"access-list ip" on page 26-2

"time-range" on page 21-60

ip access-group

This command binds an IPv4 ACL to a port. Use the **no** form to remove the port.

Syntax

ip access-group *acl-name* **in** [**time-range** *time-range-name*]

no ip access-group *acl-name* **in**

acl-name – Name of the ACL. (Maximum length: 16 characters)

in – Indicates that this list applies to ingress packets.

time-range-name - Name of the time range. (Range: 1-30 characters)

Default Setting

None

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Only one ACL can be bound to a port.
- If an ACL is already bound to a port and you bind a different ACL to it, the switch will replace the old binding with the new one.

Example

```
SSE-G2252(config)#int eth 1/2
SSE-G2252(config-if)#ip access-group david in
SSE-G2252(config-if)#
```

Related Commands

"show ip access-list" on page 26-9

"time-range" on page 21-60

show ip access-group

This command shows the ports assigned to IP ACLs.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip access-group
```

```
Interface ethernet 1/2
 IP access-list david in
SSE-G2252#
```

Related Commands

"ip access-group" on page 26-8

show ip access-list

This command displays the rules for configured IPv4 ACLs.

Syntax

show ip access-list {**standard** | **extended**} [*acl-name*]

standard – Specifies a standard IP ACL.

extended – Specifies an extended IP ACL.

acl-name – Name of the ACL. (Maximum length: 16 characters)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip access-list standard
IP standard access-list david:
  permit host 10.1.1.21
  permit 168.92.0.0 255.255.15.0
SSE-G2252#
```

Related Commands

"permit, deny, redirect-to (Standard IP ACL)" on page 26-3

"ip access-group" on page 26-8

26-2 IPv6 ACLs

The commands in this section configure ACLs based on IPv6 addresses, and next header type. To configure IPv6 ACLs, first create an access list containing the required permit or deny rules, and then bind the access list to one or more ports.

Table 26-4. IPv4 ACL Commands

Command	Function	Mode
access-list ipv6	Creates an IPv6 ACL and enters configuration mode for standard or extended IPv6 ACLs	GC
permit, deny, redirect-to (Standard IPv6 ACL)	Filters packets matching a specified source IPv6 address	IPv6-STD-ACL
permit, deny, redirect-to (Extended IPv6 ACL)	Filters packets meeting the specified criteria, including destination IPv6 address, and next header type	IPv6-EXT-ACL
show ipv6 access-list	Displays the rules for configured IPv6 ACLs	PE
ipv6 access-group	Adds a port to an IPv6 ACL	IC
show ipv6 access-group	Shows port assignments for IPv6 ACLs	PE

access-list ipv6

This command adds an IP access list and enters configuration mode for standard or extended IPv6 ACLs. Use the **no** form to remove the specified ACL.

Syntax

[**no**] **access-list ipv6** {**standard** | **extended**} *acl-name*

standard – Specifies an ACL that filters packets based on the source IP address.

extended – Specifies an ACL that filters packets based on the destination IP address, and other more specific criteria.

acl-name – Name of the ACL. (Maximum length: 16 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- When you create a new ACL or enter configuration mode for an existing ACL, use the **permit** or **deny** command to add new rules to the bottom of the list. To create an ACL, you must add at least one rule to the list.
- To remove a rule, use the **no permit** or **no deny** command followed by the exact text of a previously configured rule.
- An ACL can contain up to 64 rules.

Example

```
Console(config)#access-list ipv6 standard david
Console(config-std-ipv6-acl)#
```

Related Commands

"permit, deny, redirect-to (Standard IPv6 ACL)" on page 26-12

"permit, deny, redirect-to (Extended IPv6 ACL)" on page 26-13

"ipv6 access-group" on page 26-16

"show ipv6 access-list" on page 26-15

permit, deny, redirect-to (Standard IPv6 ACL)

This command adds a rule to a Standard IPv6 ACL. The rule sets a filter condition for packets emanating from the specified source. Use the **no** form to remove a rule.

Syntax

{**permit** | **deny** | **redirect-to** *interface*}
{**any** | **host** *source-ipv6-address* |
source-ipv6-address[*/prefix-length*]}
[**time-range** *time-range-name*]

no {**permit** | **deny**} {**any** | **host** *source-ipv6-address* |
source-ipv6-address[*/prefix-length*]}

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

any – Any source IP address.

host – Keyword followed by a specific IP address.

source-ipv6-address - An IPv6 source address or network class. The address must be formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.

prefix-length - A decimal value indicating how many contiguous bits (from the left) of the address comprise the prefix; i.e., the network portion of the address. (Range: 0-128)

time-range-name - Name of the time range.
(Range: 1-30 characters)

Default Setting

None

Command Mode

Standard IPv6 ACL

Command Usage

New rules are appended to the end of the list.

Example

This example configures one permit rule for the specific address 2009:DB9:2229::79 and another rule for the addresses with the network prefix 2009:DB9:2229:5::/64.

```
Console(config-std-ipv6-acl)#permit host 2009:DB9:2229::79
Console(config-std-ipv6-acl)#permit 2009:DB9:2229:5::/64
Console(config-std-ipv6-acl)#
```

Related Commands

"access-list ipv6" on page 26-11

"time-range" on page 21-60

permit, deny, redirect-to (Extended IPv6 ACL)

This command adds a rule to an Extended IPv6 ACL. The rule sets a filter condition for packets with specific destination IP addresses, or next header type. Use the **no** form to remove a rule.

Syntax

{**permit** | **deny** | **redirect-to** *interface*}
{**any | host** *source-ipv6-address* |
source-ipv6-address[*/prefix-length*]}
{**any** | *destination-ipv6-address*[*/prefix-length*]} [**dscp** *dscp*] [**next-header** *next-header*]
[**time-range** *time-range-name*]

no {**permit** | **deny**} {**any** | **host** *source-ipv6-address* |
source-ipv6-address[*/prefix-length*]}
{**any** | *destination-ipv6-address*[*/prefix-length*]} [**dscp** *dscp*] [**next-header** *next-header*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

any – Any IP address (an abbreviation for the IPv6 prefix ::/0).

host – Keyword followed by a specific source IP address.

source-ipv6-address - An IPv6 source address or network class. The address must be formatted according to RFC 2373 “IPv6 Addressing Architecture,” using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.

destination-ipv6-address - An IPv6 destination address or network class. The address must be formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields. (The switch only checks the first 64 bits of the destination address.)

prefix-length - A decimal value indicating how many contiguous bits (from the left) of the address comprise the prefix; i.e., the network portion of the address. (Range: 0-128 for source prefix, 0-8 for destination prefix)

dscp – DSCP traffic class. (Range: 0-63)

next-header – Identifies the type of header immediately following the IPv6 header. (Range: 0-255)

time-range-name - Name of the time range.
(Range: 1-30 characters)

Default Setting

None

Command Mode

Extended IPv6 ACL

Command Usage

- All new rules are appended to the end of the list.
- Optional internet-layer information is encoded in separate headers that may be placed between the IPv6 header and the upper-layer header in a packet. There are a small number of such extension headers, each identified by a distinct Next Header value. IPv6 supports the values defined for the IPv4 Protocol field in RFC 1700, including these commonly used headers:

0	: Hop-by-Hop Options	(RFC 2460)
6	: TCP Upper-layer Header	(RFC 1700)
17	: UDP Upper-layer Header	(RFC 1700)
43	: Routing	(RFC 2460)
44	: Fragment	(RFC 2460)
51	: Authentication	(RFC 2402)
50	: Encapsulating Security Payload	(RFC 2406)
60	: Destination Options	(RFC 2460)

Example

This example accepts any incoming packets if the destination address is 2009:DB9:2229::79/8.

```
Console(config-ext-ipv6-acl)#permit 2009:DB9:2229::79/8
Console(config-ext-ipv6-acl)#
```

This allows packets to any destination address when the DSCP value is 5.

```
Console(config-ext-ipv6-acl)#permit any dscp 5
Console(config-ext-ipv6-acl)#
```

This allows any packets sent to the destination 2009:DB9:2229::79/48 when the next header is 43."

```
Console(config-ext-ipv6-acl)#permit 2009:DB9:2229::79/48 next-header 43
Console(config-ext-ipv6-acl)#
```

Related Commands

"access-list ipv6" on page 26-11

"time-range" on page 21-60

show ipv6 access-list

This command displays the rules for configured IPv6 ACLs.

Syntax

show ipv6 access-list {**standard** | **extended**} [*acl-name*]

standard – Specifies a standard IPv6 ACL.

extended – Specifies an extended IPv6 ACL.

acl-name – Name of the ACL. (Maximum length: 16 characters)

Command Mode

Privileged Exec

Example

```
Console#show ipv6 access-list standard
IPv6 standard access-list david:
  permit host 2009:DB9:2229::79
  permit 2009:DB9:2229:5::/64
Console#
```

Related Commands

"permit, deny, redirect-to (Standard IPv6 ACL)" on page 26-12

"permit, deny, redirect-to (Extended IPv6 ACL)" on page 26-13

"ipv6 access-group" on page 26-16

ipv6 access-group

This command binds a port to an IPv6 ACL. Use the **no** form to remove the port.

Syntax

ipv6 access-group *acl-name* in [**time-range** *time-range-name*]

no ipv6 access-group *acl-name* **in**

acl-name – Name of the ACL. (Maximum length: 16 characters)

in – Indicates that this list applies to ingress packets.

time-range-name - Name of the time range.
(Range: 1-30 characters)

Default Setting

None

Command Mode

Interface Configuration (Ethernet)

Command Usage

- A port can only be bound to one ACL.
- If a port is already bound to an ACL and you bind it to a different ACL, the switch will replace the old binding with the new one.
- IPv6 ACLs can only be applied to ingress packets.

Example

```
Console(config)#int eth 1/2
Console(config-if)#ipv6 access-group standard david in
Console(config-if)#
```

Related Commands

"show ipv6 access-list" on page 26-15

"time-range" on page 21-60

show ipv6 access-group

This command shows the ports assigned to IPv6 ACLs.

Command Mode

Privileged Exec

Example

```
Console#show ip access-group
Interface ethernet 1/2
 IPv6 standard access-list david in
Console#
```

Related Commands

"ipv6 access-group" on page 26-16

26-3 MAC ACLs

The commands in this section configure ACLs based on hardware addresses, packet format, and Ethernet type. To configure MAC ACLs, first create an access list containing the required permit or deny rules, and then bind the access list to one or more ports.

Table 26-5. MAC ACL Commands

Command	Function	Mode
access-list mac	Creates a MAC ACL and enters configuration mode	GC
permit, deny, redirect-to (MAC ACL)	Filters packets matching a specified source and destination address, packet format, and Ethernet type	MAC-ACL
mac access-group	Binds a MAC ACL to a port	IC
show mac access-group	Shows port assignments for MAC ACLs	PE
show mac access-list	Displays the rules for configured MAC ACLs	PE

access-list mac

This command adds a MAC access list and enters MAC ACL configuration mode. Use the **no** form to remove the specified ACL.

Syntax

[**no**] **access-list mac** *acl-name*

acl-name – Name of the ACL. (Maximum length: 16 characters, no spaces or other special characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- When you create a new ACL or enter configuration mode for an existing ACL, use the **permit** or **deny** command to add new rules to the bottom of the list.
- To remove a rule, use the **no permit** or **no deny** command followed by the exact text of a previously configured rule.
- An ACL can contain up to 128 rules.

Example

```
SSE-G2252(config)#access-list mac jerry
SSE-G2252(config-mac-acl)#
```

Related Commands

"permit, deny, redirect-to (MAC ACL)" on page 26-19

"mac access-group" on page 26-22

"show mac access-list" on page 26-23

permit, deny, redirect-to (MAC ACL)

This command adds a rule to a MAC ACL. The rule filters packets matching a specified MAC source or destination address (i.e., physical layer address), or Ethernet protocol type. Use the **no** form to remove a rule.

Syntax

{**permit** | **deny** | **redirect-to** *interface*}
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**vid** *vid vid-bitmask*] [**ethertype** *protocol* [*protocol-bitmask*]] [**time-range** *time-range-name*]

no {**permit** | **deny** | **redirect-to** *interface*}
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**vid** *vid vid-bitmask*] [**ethertype** *protocol* [*protocol-bitmask*]]

NOTE: The default is for Ethernet II packets.

{**permit** | **deny** | **redirect-to** *interface*} **tagged-eth2**
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**vid** *vid vid-bitmask*] [**ethertype** *protocol* [*protocol-bitmask*]] [**time-range** *time-range-name*]

no {**permit** | **deny** | **redirect-to** *interface*} **tagged-eth2**
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**vid** *vid vid-bitmask*] [**ethertype** *protocol* [*protocol-bitmask*]]

{**permit** | **deny** | **redirect-to** *interface*} **untagged-eth2**
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**ethertype** *protocol* [*protocol-bitmask*]]
[**time-range** *time-range-name*]

no {**permit** | **deny** | **redirect-to** *interface*} **untagged-eth2**
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**ethertype** *protocol* [*protocol-bitmask*]]

{**permit** | **deny** | **redirect-to** *interface*} **tagged-802.3**
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**vid** *vid vid-bitmask*] [**time-range** *time-range-name*]

no {**permit** | **deny** | **redirect-to** *interface*} **tagged-802.3**
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**vid** *vid vid-bitmask*]

{**permit** | **deny** | **redirect-to** *interface*} **untagged-802.3**
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}
[**time-range** *time-range-name*]

no {**permit** | **deny** | **redirect-to** *interface*} **untagged-802.3**
{**any** | **host** *source* | *source address-bitmask*}
{**any** | **host** *destination* | *destination address-bitmask*}

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

tagged-eth2 – Tagged Ethernet II packets.

untagged-eth2 – Untagged Ethernet II packets.

tagged-802.3 – Tagged Ethernet 802.3 packets.

untagged-802.3 – Untagged Ethernet 802.3 packets.

any – Any MAC source or destination address.

host – A specific MAC address.

source – Source MAC address.

destination – Destination MAC address range with bitmask.

address-bitmask[2] – Bitmask for MAC address (in hexadecimal format).

vid – VLAN ID. (Range: 1-4094)

vid-bitmask[2] – VLAN bitmask. (Range: 1-4095)

protocol – A specific Ethernet protocol number. (Range: 600-ffff hex.)

protocol-bitmask[2] – Protocol bitmask.
(Range: 600-ffff hex.)

time-range-name - Name of the time range.
(Range: 1-30 characters)

Default Setting

None

2. For all bitmasks, "1" means care and "0" means ignore.

Command Mode

MAC ACL

Command Usage

- New rules are added to the end of the list.
- The **ethertype** option can only be used to filter Ethernet II formatted packets.
- A detailed listing of Ethernet protocol types can be found in RFC 1060. A few of the more common types include the following:
  - 0800 - IP
  - 0806 - ARP
  - 8137 - IPX

Example

This rule permits packets from any source MAC address to the destination address 00-e0-29-94-34-de where the Ethernet type is 0800.

```
SSE-G2252(config-mac-acl)#permit any host 00-e0-29-94-34-de ethertype 0800
SSE-G2252(config-mac-acl)#
```

Related Commands

"access-list mac" on page 26-18

"time-range" on page 21-60

mac access-group

This command binds a MAC ACL to a port. Use the **no** form to remove the port.

Syntax

mac access-group *acl-name* **in** [**time-range** *time-range-name*]

acl-name – Name of the ACL. (Maximum length: 16 characters)

in – Indicates that this list applies to ingress packets.

time-range-name - Name of the time range. (Range: 1-30 characters)

Default Setting

None

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Only one ACL can be bound to a port.
- If an ACL is already bound to a port and you bind a different ACL to it, the switch will replace the old binding with the new one.

Example

```
SSE-G2252(config)#interface ethernet 1/2
SSE-G2252(config-if)#mac access-group jerry in
SSE-G2252(config-if)#
```

Related Commands

"show mac access-list" on page 26-23

"time-range" on page 21-60

show mac access-group

This command shows the ports assigned to MAC ACLs.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show mac access-group
Interface ethernet 1/5
 MAC access-list M5 in
SSE-G2252#
```

Related Commands

mac access-group

show mac access-list

This command displays the rules for configured MAC ACLs.

Syntax

show mac access-list [*acl-name*]

acl-name – Name of the ACL. (Maximum length: 16 characters)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show mac access-list
MAC access-list jerry:
  permit any 00-e0-29-94-34-de ethertype 0800
SSE-G2252#
```

Related Commands

"permit, deny, redirect-to (MAC ACL)" on page 26-19

"mac access-group" on page 26-22

26-4 ARP ACLs

The commands in this section configure ACLs based on the IP or MAC address contained in ARP request and reply messages. To configure ARP ACLs, first create an access list containing the required permit or deny rules, and then bind the access list to one or more VLANs using the ip arp inspection vlan command (page 25-48).

Table 26-6. ARP ACL Commands

Command	Function	Mode
access-list arp	Creates a ARP ACL and enters configuration mode	GC
permit, deny (ARP ACL)	Filters packets matching a specified source or destination address in ARP messages	ARP-ACL
show arp access-list	Displays the rules for configured ARP ACLs	PE

access-list arp

This command adds an ARP access list and enters ARP ACL configuration mode. Use the **no** form to remove the specified ACL.

Syntax

[**no**] **access-list arp** *acl-name*

acl-name – Name of the ACL. (Maximum length: 16 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- When you create a new ACL or enter configuration mode for an existing ACL, use the **permit** or **deny** command to add new rules to the bottom of the list. To create an ACL, you must add at least one rule to the list.
- To remove a rule, use the **no permit** or **no deny** command followed by the exact text of a previously configured rule.
- An ACL can contain up to 128 rules.

Example

```
SSE-G2252(config)#access-list arp factory
SSE-G2252(config-arp-acl)#
```

Related Commands

"permit, deny (ARP ACL)" on page 26-25

"show arp access-list" on page 26-26

permit, deny (ARP ACL)

This command adds a rule to an ARP ACL. The rule filters packets matching a specified source or destination address in ARP messages. Use the **no** form to remove a rule.

Syntax

[**no**] {**permit** | **deny**}
ip {**any** | **host** *source-ip* | *source-ip ip-address-bitmask*}
mac {**any** | **host** *source-ip* | *source-ip ip-address-bitmask*} [**log**]

This form indicates either request or response packets.

[**no**] {**permit** | **deny**} **request**
ip {**any** | **host** *source-ip* | *source-ip ip-address-bitmask*}
mac {**any** | **host** *source-mac* | *source-mac mac-address-bitmask*} [**log**]

[**no**] {**permit** | **deny**} **response**
ip {**any** | **host** *source-ip* | *source-ip ip-address-bitmask*}
{**any** | **host** *destination-ip* | *destination-ip ip-address-bitmask*}
mac {**any** | **host** *source-mac* | *source-mac mac-address-bitmask*}
[**any** | **host** *destination-mac* | *destination-mac mac-address-bitmask*] [**log**]

source-ip – Source IP address.

destination-ip – Destination IP address with bitmask.

ip-address-bitmask[3] – IPv4 number representing the address bits to match.

source-mac – Source MAC address.

destination-mac – Destination MAC address range with bitmask.

mac-address-bitmask[3] – Bitmask for MAC address (in hexadecimal format).

log - Logs a packet when it matches the access control entry.

Default Setting

None

Command Mode

ARP ACL

Command Usage

New rules are added to the end of the list.

3. For all bitmasks, binary “1” means care and “0” means ignore.

Example

This rule permits packets from any source IP and MAC address to the destination subnet address 192.168.0.0.

```
SSE-G2252(config-arp-acl)#$permit response ip any 192.168.0.0 255.255.0.0
mac any any
SSE-G2252(config-mac-acl)#
```

Related Commands

"access-list arp" on page 26-24

show arp access-list

This command displays the rules for configured ARP ACLs.

Syntax

show arp access-list [*acl-name*]

acl-name – Name of the ACL. (Maximum length: 16 characters)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show arp access-list
ARP access-list factory:
  permit response ip any 192.168.0.0 255.255.0.0 mac any any
SSE-G2252#
```

Related Commands

"permit, deny (ARP ACL)" on page 26-25

26-5 ACL Information

This section describes commands used to display ACL information.

Table 26-7. ACL Information Commands

Command	Function	Mode
show access-group	Shows the ACLs assigned to each port	PE
show access-list	Show all ACLs and associated rules	PE

show access-group

This command shows the port assignments of ACLs.

Command Mode

Privileged Executive

Example

```
SSE-G2252#show access-group
Interface ethernet 1/2
 IP access-list david
 MAC access-list jerry
SSE-G2252#
```

show access-list

This command shows all ACLs and associated rules.

Syntax

show access-list
[[**arp** [*acl-name*]] |
[**ip** [**extended** [*acl-name*] | **standard** [*acl-name*]] |
[**ipv6** [**extended** [*acl-name*] | **standard** [*acl-name*]] |
[**mac** [*acl-name*]] |
[**tcam-utilization**]]

arp – Shows ingress or egress rules for ARP ACLs.

ip extended – Shows ingress rules for Extended IPv4 ACLs.

ip standard – Shows ingress rules for Standard IPv4 ACLs.

ipv6 extended – Shows ingress rules for Extended IPv6 ACLs.

ipv6 standard – Shows ingress rules for Standard IPv6 ACLs.

mac – Shows ingress rules for MAC ACLs.

tcam-utilization – Shows the percentage of user configured ACL rules as a percentage of total ACL rules

acl-name – Name of the ACL. (Maximum length: 16 characters)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show access-list
IP standard access-list david:
  permit host 10.1.1.21
  permit 168.92.0.0 255.255.15.0
IP extended access-list bob:
  permit 10.7.1.1 255.255.255.0 any
  permit 192.168.1.0 255.255.255.0 any destination-port 80 80
  permit 192.168.1.0 255.255.255.0 any protocol tcp control-code 2 2
MAC access-list jerry:
  permit any host 00-30-29-94-34-de ethertype 800 800
IP extended access-list A6:
  deny tcp any any control-flag 2 2
  permit any any
SSE-G2252#
```

Chapter 27
Interface Commands

These commands are used to display or set communication parameters for an Ethernet port, aggregated link, or VLAN; or perform cable diagnostics on the specified interface.

Table 27-1. Interface Commands

Command	Function	Mode
Interface Configuration		
interface	Configures an interface type and enters interface configuration mode	GC
alias	Configures an alias name for the interface	IC
capabilities	Advertises the capabilities of a given interface for use in autonegotiation	IC
description	Adds a description to an interface configuration	IC
flowcontrol	Enables flow control on a given interface	IC
giga-phy-mode	Forces two connected ports in to a master/slave configuration to enable 1000BASE-T full duplex	IC
media-type	Force port type selected for combination ports	IC
negotiation	Enables autonegotiation of a given interface	IC
shutdown	Disables an interface	IC
speed-duplex	Configures the speed and duplex operation of a given interface when autonegotiation is disabled	IC
switchport packet-rate[a]	Configures broadcast, multicast, and unknown unicast storm control thresholds	IC
clear counters	Clears statistics on an interface	PE
show interfaces counters	Displays statistics for the specified interfaces	NE, PE
show interfaces status	Displays status for the specified interface	NE, PE
show interfaces switchport	Displays the administrative and operational status of an interface	NE, PE
show interfaces transceiver	Displays the temperature, voltage, bias current, transmit power, and receive power	PE
Cable Diagnostics		
test cable-diagnostics	Performs cable diagnostics on the specified port	PE
show cable-diagnostics	Shows the results of a cable diagnostics test	PE

Table 27-1. Interface Commands (Continued)

Command	Function	Mode
Power Savings		
power-save	Enables power savings mode on the specified port	IC
show power-save	Shows the configuration settings for power savings	PE

a. Enabling hardware-level storm control with this command on a port will disable software-level automatic storm control on the same port if configured by the auto-traffic-control command (page 32-3).

interface

This command configures an interface type and enters interface configuration mode. Use the **no** form with a trunk to remove an inactive interface.

Syntax

[**no**] **interface** *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

loopback *number* - Loopback interface for local testing.

number - Interface number. (Range: 0)

port-channel *channel-id* (Range: 1-12)

vlan *vlan-id* (Range: 1-4093)

Default Setting

None

Command Mode

Global Configuration

Command Usage

The loopback interface is a virtual interface that is always up, and can be used to test the functionality of the switch's local IP interfaces (including the IP interface of the primary VLAN or the craft port) or devices attached to a local interface.

Example

To specify port 4, enter the following command:

```
SSE-G2252(config)#interface ethernet 1/4
SSE-G2252(config-if)#
```

alias

This command configures an alias name for the interface. Use the **no** form to remove the alias name.

Syntax

alias *string*

no alias

string - A mnemonic name to help you remember what is attached to this interface. (Range: 1-64 characters)

Default Setting

None

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

The alias is displayed in the running-configuration file. An example of the value which a network manager might store in this object for a WAN interface is the (Telco's) circuit number/identifier of the interface.

Example

The following example adds an alias to port 4.

```
SSE-G2252(config)#interface ethernet 1/4
SSE-G2252(config-if)#alias finance
SSE-G2252(config-if)#
```

capabilities

This command advertises the port capabilities of a given interface during auto-negotiation. Use the **no** form with parameters to remove an advertised capability, or the **no** form without parameters to restore the default values.

Syntax

[**no**] **capabilities** {**1000full** | **100full** | **100half** | **10full** | **10half** | **flowcontrol** | **symmetric**}

1000full - Supports 1 Gbps full-duplex operation

100full - Supports 100 Mbps full-duplex operation

100half - Supports 100 Mbps half-duplex operation

10full - Supports 10 Mbps full-duplex operation

10half - Supports 10 Mbps half-duplex operation

flowcontrol - Supports flow control

symmetric (Gigabit only) - When specified, the port transmits and receives symmetric pause frames.

Default Setting

100BASE-TX: 10half, 10full, 100half, 100full

1000BASE-T: 10half, 10full, 100half, 100full, 1000full

1000BASE-SX/LX/LH (SFP): 1000full

Command Mode

Interface Configuration (Ethernet, Port Channel)

- Command Usage
- The 1000BASE-T standard does not support forced mode. Auto-negotiation should always be used to establish a connection over any 1000BASE-T port or trunk.
- When auto-negotiation is enabled with the negotiation command, the switch will negotiate the best settings for a link based on the **capabilities** command. When auto-negotiation is disabled, you must manually specify the link attributes with the speed-duplex and flowcontrol commands.

Example

The following example configures Ethernet port 5 capabilities to include 100half and 100full.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#capabilities 100half
SSE-G2252(config-if)#capabilities 100full
SSE-G2252(config-if)#capabilities flowcontrol
```

```
SSE-G2252(config-if)#
```

Related Commands

"negotiation" on page 27-9

"speed-duplex" on page 27-10

"flowcontrol" on page 27-6

description

This command adds a description to an interface. Use the **no** form to remove the description.

Syntax

description *string*

no description

string - Comment or a description to help you remember what is attached to this interface. (Range: 1-64 characters)

Default Setting

None

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

The description is displayed by the show interfaces status command and in the running-configuration file. An example of the value which a network manager might store in this object is the name of the manufacturer, and the product name.

Example

The following example adds a description to port 4.

```
SSE-G2252(config)#interface ethernet 1/4
SSE-G2252(config-if)#description RD-SW#3
SSE-G2252(config-if)#
```

flowcontrol

This command enables flow control. Use the **no** form to disable flow control.

Syntax

[**no**] **flowcontrol**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- 1000BASE-T does not support forced mode. Auto-negotiation should always be used to establish a connection over any 1000BASE-T port or trunk.
- Flow control can eliminate frame loss by "blocking" traffic from end stations or segments connected directly to the switch when its buffers fill. When enabled, back pressure is used for half-duplex operation and IEEE 802.3-2002 (formally IEEE 802.3x) for full-duplex operation.
- To force flow control on or off (with the **flowcontrol** or **no flowcontrol** command), use the **no negotiation** command to disable auto-negotiation on the selected interface.
- When using the negotiation command to enable auto-negotiation, the optimal settings will be determined by the capabilities command. To enable flow control under auto-negotiation, "flowcontrol" must be included in the capabilities list for any port
- Avoid using flow control on a port connected to a hub unless it is actually required to solve a problem. Otherwise back pressure jamming signals may degrade overall performance for the segment attached to the hub.

Example

The following example enables flow control on port 5.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#flowcontrol
SSE-G2252(config-if)#no negotiation
SSE-G2252(config-if)#
```

Related Commands

"negotiation" on page 27-9

"capabilities" on page 27-4 (flowcontrol, symmetric)

giga-phy-mode

This command forces two connected ports into a master/slave configuration to enable 1000BASE-T full duplex for Gigabit ports. Use the **no** form to restore the default mode.

Syntax

giga-phy-mode *mode*

no giga-phy-mode

mode

master - Sets the selected port as master.

slave - Sets the selected port as slave.

Default Setting

master

Command Mode

Interface Configuration (Ethernet - Range: 1-52)

Command Usage

- The 1000BASE-T standard does not support forced mode. Auto-negotiation should always be used to establish a connection over any 1000BASE-T port or trunk. If not used, the success of the link process cannot be guaranteed when connecting to other types of switches. However, this switch does provide a means of forcing a link to operate at 1000 Mbps, full-duplex using the **giga-phy-mode** command.
- To force 1000full operation requires the ports at both ends of a link to establish their role in the connection process as a master or slave. Before using this feature, auto-negotiation must first be disabled, and the Speed/Duplex attribute set to 1000full. Then select compatible Giga PHY modes at both ends of the link.
- If auto-negotiation is enabled at the far end of a link, and disabled on the local end, a link should eventually be established regardless of the selected giga-phy mode.

Example

This forces the switch port to master mode on port 24.

```
Console(config)#interface ethernet 1/50
Console(config-if)#no negotiation
Console(config-if)#speed-duplex 1000full
Console(config-if)#giga-phy-mode master
Console(config-if)#
```

media-type

This command forces the port type selected for the combination ports. Use the **no** form to restore the default mode.

Syntax

media-type *mode*

no media-type

mode

copper-forced - Always uses the built-in RJ-45 port.

sfp-forced - Always uses the SFP port (even if module not installed).

sfp-preferred-auto - Uses SFP port if both combination types are functioning and the SFP port has a valid link.

Default Setting

RJ-45: copper-forced

Combination: sfp-preferred-auto

Command Mode

Interface Configuration (Ethernet - Ports 49-52 on the SSE-G2252/P)

Example

This forces the switch to use the built-in RJ-45 port for the combination port 50.

```
SSE-G2252(config)#interface ethernet 1/50
SSE-G2252(config-if)#media-type copper-forced
SSE-G2252(config-if)#
```

negotiation

This command enables auto-negotiation for a given interface. Use the **no** form to disable auto-negotiation.

Syntax

[**no**] **negotiation**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- 1000BASE-T does not support forced mode. Auto-negotiation should always be used to establish a connection over any 1000BASE-T port or trunk.
- When auto-negotiation is enabled the switch will negotiate the best settings for a link based on the capabilities command. When auto-negotiation is disabled, you must manually specify the link attributes with the speed-duplex and flowcontrol commands.
- If auto-negotiation is disabled, auto-MDI/MDI-X pin signal configuration will also be disabled for the RJ-45 ports.

Example

The following example configures port 11 to use auto-negotiation.

```
SSE-G2252(config)#interface ethernet 1/11
SSE-G2252(config-if)#negotiation
SSE-G2252(config-if)#
```

Related Commands

"capabilities" on page 27-4

"speed-duplex" on page 27-10

shutdown

This command disables an interface. To restart a disabled interface, use the **no** form.

Syntax

[**no**] **shutdown**

Default Setting

All interfaces are enabled.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This command allows you to disable a port due to abnormal behavior (e.g., excessive collisions), and then re-enable it after the problem has been resolved. You may also want to disable a port for security reasons.

Example

The following example disables port 5.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#shutdown
SSE-G2252(config-if)#
```

speed-duplex

This command configures the speed and duplex mode of a given interface when auto-negotiation is disabled. Use the **no** form to restore the default.

Syntax

speed-duplex {**1000full** | **100full** | **100half** | **10full** | **10half**}

no speed-duplex

1000full - Forces 1000 Mbps full-duplex operation

100full - Forces 100 Mbps full-duplex operation

100half - Forces 100 Mbps half-duplex operation

10full - Forces 10 Mbps full-duplex operation

10half - Forces 10 Mbps half-duplex operation

Default Setting

- Auto-negotiation is enabled by default.
- When auto-negotiation is disabled, the default speed-duplex setting is:
  - Fast Ethernet ports – **100full** for 100BASE-TX ports
  - Gigabit Ethernet ports – **100full** for 1000BASE-T ports

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- The 1000BASE-T standard does not support forced mode. Auto-negotiation should always be used to establish a connection over any 1000BASE-T port or trunk. If not used, the success of the link process cannot be guaranteed when connecting to other types of switches. However, this switch does provide a means of safely forcing a link to operate at 1000 Mbps, full-duplex using the **giga-phy-mode** command.
- To force operation to the speed and duplex mode specified in a **speed-duplex** command, use the no negotiation command to disable auto-negotiation on the selected interface.
- When using the negotiation command to enable auto-negotiation, the optimal settings will be determined by the capabilities command. To set the speed/duplex mode under auto-negotiation, the required mode must be specified in the capabilities list for an interface.

Example

The following example configures port 5 to 100 Mbps, half-duplex operation.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#speed-duplex 100half
SSE-G2252(config-if)#no negotiation
SSE-G2252(config-if)#
```

Related Commands

"negotiation" on page 27-9

"capabilities" on page 27-4

switchport packet-rate

This command configures broadcast, multicast and unknown unicast storm control. Use the **no** form to restore the default setting.

Syntax

switchport {**broadcast** | **multicast** | **unicast**} **packet-rate** *rate*

no switchport {**broadcast** | **multicast** | **unicast**}

broadcast - Specifies storm control for broadcast traffic.

multicast - Specifies storm control for multicast traffic.

unicast - Specifies storm control for unknown unicast traffic.

rate - Threshold level as a rate; i.e., kilobits per second. (Range: 64-100000 Kbps for Fast Ethernet ports, 64-1000000 Kbps for Gigabit Ethernet ports)

Default Setting

Broadcast Storm Control: Disabled

Multicast Storm Control: Disabled

Unknown Unicast Storm Control: Disabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

- When traffic exceeds the threshold specified for broadcast and multicast or unknown unicast traffic, packets exceeding the threshold are dropped until the rate falls back down beneath the threshold.
- Traffic storms can be controlled at the hardware level using this command or at the software level using the auto-traffic-control command. However, only one of these control types can be applied to a port. Enabling hardware-level storm control on a port will disable automatic storm control on that port.
- The rate limits set by this command are also used by automatic storm control when the control response is set to rate limiting by the auto-traffic-control action command.
- Using both rate limiting and storm control on the same interface may lead to unexpected results. For example, suppose broadcast storm control is set to 500 Kbps by the command "switchport broadcast packet-rate 500," and the rate limit is set to 20000 Kbps by the command "rate-limit input 20000" on a Fast Ethernet port. Since 20000 Kbps is 1/5 of line speed (100 Mbps), the received rate will actually be 100 Kbps, or 1/5 of the 500 Kbps limit set by the storm control command. It is therefore not advisable to use both of these commands on the same interface.

- The description of effective rate limiting (see Command Usage under Section 10-1: "Rate Limiting" on page 10-1) also applies to storm control.

NOTE: Due to a chip limitation, the switch supports only one limit for both ingress rate limiting and storm control (including broadcast unknown unicast, multicast, and broadcast storms).

Example

The following shows how to configure broadcast storm control at 600 kilobits per second:

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#switchport broadcast packet-rate 600
SSE-G2252(config-if)#
```

clear counters

This command clears statistics on an interface.

Syntax

clear counters *interface*

interface

ethernet *unit/port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

None

Command Mode

Privileged Exec

Command Usage

Statistics are only initialized for a power reset. This command sets the base value for displayed statistics to zero for the current management session. However, if you log out and back into the management interface, the statistics displayed will show the absolute value accumulated since the last power reset.

Example

The following example clears statistics on port 5.

```
SSE-G2252#clear counters ethernet 1/5
SSE-G2252#
```

show interfaces counters

This command displays interface statistics.

Syntax

show interfaces counters [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

Shows the counters for all interfaces.

Command Mode

Normal Exec, Privileged Exec

Command Usage

If no interface is specified, information on all interfaces is displayed. For a description of the items displayed by this command, see "Showing Port or Trunk Statistics" on page 6-13.

Example

```
SSE-G2252#show interfaces counters ethernet 1/17
Ethernet 1/ 17
 ===== IF table Stats =====
                2166458 Octets Input
               14734059 Octets Output
                  14707 Unicast Input
                  19806 Unicast Output
                      0 Discard Input
                      0 Discard Output
                      0 Error Input
                      0 Error Output
                      0 Unknown Protos Input
                      0 QLen Output
 ===== Extended Iftable Stats =====
                     23 Multi-cast Input
```

```
                    5525 Multi-cast Output
                     170 Broadcast Input
                      11 Broadcast Output
 ===== Ether-like Stats =====
                       0 Alignment Errors
                       0 FCS Errors
                       0 Single Collision Frames
                       0 Multiple Collision Frames
                       0 SQE Test Errors
                       0 Deferred Transmissions
                       0 Late Collisions
                       0 Excessive Collisions
                       0 Internal Mac Transmit Errors
                       0 Internal Mac Receive Errors
                       0 Frames Too Long
                       0 Carrier Sense Errors
                       0 Symbol Errors
 ===== RMON Stats =====
                       0 Drop Events
                16900558 Octets
                   40243 Packets
                     170 Broadcast PKTS
                      23 Multi-cast PKTS
                       0 Undersize PKTS
                       0 Oversize PKTS
                       0 Fragments
                       0 Jabbers
                       0 CRC Align Errors
                       0 Collisions
                   21065 Packet Size <= 64 Octets
                    3805 Packet Size 65 to 127 Octets
                    2448 Packet Size 128 to 255 Octets
                     797 Packet Size 256 to 511 Octets
                    2941 Packet Size 512 to 1023 Octets
                    9187 Packet Size 1024 to 1518 Octets
 ===== Port Utilization (recent 300 seconds) =====
                       0 Octets input per second
                       0 Packets input per second
                    0.00 % Input utilization
                       0 Octets output per second
                       0 Packets output per second
                    0.00 % Output utilization
SSE-G2252#
```

show interfaces status

This command displays the status for an interface.

Syntax

show interfaces status [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

vlan *vlan-id* (Range: 1-4093)

Default Setting

Shows the status for all interfaces.

Command Mode

Normal Exec, Privileged Exec

Command Usage

If no interface is specified, information on all interfaces is displayed. For a description of the items displayed by this command, see "Displaying Connection Status" on page 6-6.

Example

```
SSE-G2252#show interfaces status ethernet 1/21
Information of Eth 1/21
 Basic Information:
  Port Type              : 100TX
  Mac Address            : 00-E0-0C-00-00-FE
 Configuration:
  Name                   :
  Port Admin             : Up
  Speed-duplex           : Auto
  Capabilities           : 10half, 10full, 100half, 100full
  Broadcast Storm        : Enabled
  Broadcast Storm Limit  : 500 packets/second
  Multicast Storm        : Disabled
  Multicast Storm Limit  : 64 Kbits/second
  Unknown Unicast Storm       : Disabled
  Unknown Unicast Storm Limit : 64 Kbits/second
  Flow Control           : Disabled
  LACP                   : Disabled
  Port Security          : Disabled
  Max MAC Count          : 0
  Port Security Action   : None
  Media Type             : Copper forced
  Giga PHY mode          : Master
 Current Status:
  Link Status            : Up
  Port Operation Status  : Up
  Operation Speed-duplex : 100full
  Flow Control Type      : None
SSE-G2252#
```

show interfaces switchport

This command displays the administrative and operational status of the specified interfaces.

Syntax

show interfaces switchport [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

Shows all interfaces.

Command Mode

Normal Exec, Privileged Exec

Command Usage

If no interface is specified, information on all interfaces is displayed.

Example

This example shows the configuration setting for port 21.

```
SSE-G2252#show interfaces switchport ethernet 1/21
Information of Eth 1/21
 Broadcast Threshold           : Enabled, 500 packets/second
 Multicast Threshold           : Disabled
 Unknown Unicast Threshold     : Disabled
 LACP Status                   : Disabled
 Ingress Rate Limit            : Disabled, 1000M bits per second
 Egress Rate Limit             : Disabled, 1000M bits per second
 VLAN Membership Mode          : Hybrid
 Ingress Rule                  : Disabled
 Acceptable Frame Type         : All frames
 Native VLAN                   : 1
 Priority for Untagged Traffic : 0
 GVRP Status                   : Disabled
 Allowed VLAN                  :     1(u)
 Forbidden VLAN                :
 802.1Q-tunnel Status          : Disable
 802.1Q-tunnel Mode            : NORMAL
 802.1Q-tunnel TPID            : 8100(Hex)
SSE-G2252#
```

Table 27-2. show interfaces switchport - Display Description

Field	Description
Broadcast Threshold	Shows if broadcast storm suppression is enabled or disabled; if enabled it also shows the threshold level ("switchport packet-rate" on page 27-12).
Multicast Threshold	Shows if multicast storm suppression is enabled or disabled; if enabled it also shows the threshold level ("switchport packet-rate" on page 27-12).
Unknown-unicast Threshold	Shows if unknown unicast storm suppression is enabled or disabled; if enabled it also shows the threshold level ("switchport packet-rate" on page 27-12).
LACP Status	Shows if Link Aggregation Control Protocol has been enabled or disabled (page 28-3).
Ingress/Egress Rate Limit	Shows if rate limiting is enabled, and the current rate limit (page 31-1).
VLAN Membership Mode	Indicates membership mode as Trunk or Hybrid (page 35-14).
Ingress Rule	Shows if ingress filtering is enabled or disabled (page 35-14).
Acceptable Frame Type	Shows if acceptable VLAN frames include all types or tagged frames only (page 35-12).
Native VLAN	Indicates the default Port VLAN ID (page 35-16).
Priority for Untagged Traffic	Indicates the default priority for untagged frames (page 36-5).
GVRP Status	Shows if GARP VLAN Registration Protocol is enabled or disabled (page 35-5).
Allowed VLAN	Shows the VLANs this interface has joined, where "(u)" indicates untagged and "(t)" indicates tagged (page 35-13).

Table 27-2. show interfaces switchport - Display Description (Continued)

Field	Description
Forbidden VLAN	Shows the VLANs this interface can not dynamically join via GVRP (page 35-4).
802.1Q-tunnel Status	Shows if 802.1Q tunnel is enabled on this interface (page 35-21).
802.1Q-tunnel Mode	Shows the tunnel mode as Normal, 802.1Q Tunnel or 802.1Q Tunnel Uplink (page 35-22).
802.1Q-tunnel TPID	Shows the Tag Protocol Identifier used for learning and switching packets (page 35-23).

show interfaces transceiver

This command displays identifying information for the specified transceiver, as well as the temperature, voltage, bias current, transmit power, and receive power.

Syntax

show interfaces transceiver [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 49-52)

Default Setting

Shows all SFP interfaces.

Command Mode

Privileged Exec

Command Usage

The switch can display diagnostic information for SFP modules which support the SFF-8472 Specification for Diagnostic Monitoring Interface for Optical Transceivers. This information allows administrators to remotely diagnose problems with optical devices.

Example

```
Console#show interfaces transceiver ethernet 1/25
SFP Information of Ethernet 1/25
 Identifier : Unknown or unspecified
 Connector  : LC
 Transceiver:
  Gigabit Ethernet Compliance Codes:
   1000BASE-SX
  Fibre Channel link length:
   intermediate distance(I)
  Fibre Channel transmitter technology:
   Shortwave laser w/o OFC(SN)
  Fibre Channel transmission media:
   Multimode, 50um(M5, M5E)
   Multimode, 62.5um(M6)
  Fibre Channel Speed:
   100 MBytes/sec
 Encoding   : 8B/10B
 BR.Norminal: 13MBits/sec
 BR.MAX     : 0
 BR.MIN     : 0
 Length     :
  Link length supported for OM2 fiber, 550m
  Link length supported for OM1 fiber, 280m
 Vendor Name: SMC Networks
 Vendor OUI : 0
 Vendor PN  : SMC1GSFP-SX
 Vendor Rev : V1.1
 Vendor SN  : V1.1
 Date code  : 2009.5.19
 Options    :
Console#
```

test cable-diagnostics

This command performs cable diagnostics on the specified port to diagnose any cable faults (short, open, etc.) and report the cable length.

Syntax

test cable-diagnostics interface *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Command Mode

Privileged Exec

Command Usage

- Cable diagnostics are performed using Digital Signal Processing (DSP) test methods.
- This cable test is only accurate for Fast Ethernet cables 50-140 meters long, and Gigabit Ethernet cables 0 - 250 meters long.
- The test takes approximately 5 seconds. The switch displays the results of the test immediately upon completion, including common cable failures, as well as the status and approximate length of each cable pair.
- Potential conditions which may be listed by the diagnostics include:
  - OK: Correctly terminated pair
  - Open: Open pair, no link partner
  - Short: Shorted pair
  - Not Supported: This message is displayed for any Fast Ethernet ports that are linked up, or for any Gigabit Ethernet ports linked up at a speed lower than 1000 Mbps.
  - Impedance mismatch: Terminating impedance is not in the reference range.
- Ports are linked down while running cable diagnostics.
- To ensure more accurate measurement of the length to a fault, first disable power-saving mode (using the no power-save command) on the link partner before running cable diagnostics.

Example

```
SSE-G2252#test cable-diagnostics interface ethernet 1/23
SSE-G2252#show cable-diagnostics interface ethernet 1/23
Port     Type Link Status Pair A (meters)  Pair B (meters)  Last Update
-------- ---- ----------- ---------------- ----------------
-----------------
Eth 1/23   GE  Up          OK (21)          OK (21)          2009-11-13
09:44:19
SSE-G2252#
```

show cable-diagnostics

This command shows the results of a cable diagnostics test.

SYNTAX

show cable-diagnostics interface [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Command Mode

Privileged Exec

Command Usage

For link-down ports, the reported distance to a fault is accurate to within +/- 2 meters.

For link-up ports, the accuracy is +/- 10 meters.

Example

```
SSE-G2252#show cable-diagnostics interface ethernet 1/23
SSE-G2252#show cable-diagnostics interface e 1/23
Port     Type Link Status Pair A (meters)  Pair B (meters)  Last Update
-------- ---- ----------- ---------------- ----------------
-----------------
Eth 1/23   GE  Up          OK (21)          OK (21)          2009-11-13
09:44:19
SSE-G2252#
```

power-save

This command enables power savings mode on the specified port.

Syntax

[**no**] **power-save**

Command Mode

Interface Configuration (Ethernet)

Command Usage

- IEEE 802.3 defines the Ethernet standard and subsequent power requirements based on cable connections operating at 100 meters. Enabling power saving mode can reduce power used for cable lengths of 60 meters or less, with more significant reduction for cables of 20 meters or less, and continue to ensure signal integrity.
- Power saving mode only applies to the Gigabit Ethernet ports using copper media.
- Power savings can be enabled on Gigabit Ethernet RJ-45 ports.
- The power-saving methods provided by this switch include:
  - Power saving when there is no link partner:

    Under normal operation, the switch continuously auto-negotiates to find a link partner, keeping the MAC interface powered up even if no link connection exists. When using power-savings mode, the switch checks for energy on the circuit to determine if there is a link partner. If none is detected, the switch automatically turns off the transmitter, and most of the receive circuitry (entering Sleep Mode). In this mode, the low-power energy-detection circuit continuously checks for energy on the cable. If none is detected, the MAC interface is also powered down to save additional energy. If energy is detected, the switch immediately turns on both the transmitter and receiver functions, and powers up the MAC interface.
  - Power saving when there is a link partner:

    Traditional Ethernet connections typically operate with enough power to support at least 100 meters of cable even though average network cable length is shorter. When cable length is shorter, power consumption can be reduced since signal attenuation is proportional to cable length. When power-savings mode is enabled, the switch analyzes cable length to determine whether or not it can reduce the signal amplitude used on a particular link.

NOTE: Power-savings mode on a active link only works when the connection speed is 100 Mbps or higher at linkup, and line length is less than 60 meters.

NOTE: Power savings can only be implemented on Gigabit Ethernet ports using twisted-pair cabling. Power-savings mode on a active link only works when connection speed is 1 Gbps, and line length is less than 60 meters.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#power-save
SSE-G2252(config-if)#
```

show power-save

This command shows the configuration settings for power savings.

Syntax

show power-save [interface *interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show power-save interface ethernet 1/4

   Power Saving Status      : Enabled
SSE-G2252#
```

Chapter 28
Link Aggregation Commands

Ports can be statically grouped into an aggregate link (i.e., trunk) to increase the bandwidth of a network connection or to ensure fault recovery. Or you can use the Link Aggregation Control Protocol (LACP) to automatically negotiate a trunk link between this switch and another network device. For static trunks, the switches have to comply with the Cisco EtherChannel standard. For dynamic trunks, the switches have to comply with LACP. This switch supports up to 12 trunks. For example, a trunk consisting of two 1000 Mbps ports can support an aggregate bandwidth of 4 Gbps when operating at full duplex.

Table 28-1. Link Aggregation Commands

Command	Function	Mode
Manual Configuration Commands		
interface port-channel	Configures a trunk and enters interface configuration mode for the trunk	GC
channel-group	Adds a port to a trunk	IC (Ethernet)
Dynamic Configuration Commands		
lacp	Configures LACP for the current interface	IC (Ethernet)
lacp admin-key	Configures a port's administration key	IC (Ethernet)
lacp port-priority	Configures a port's LACP port priority	IC (Ethernet)
lacp system-priority	Configures a port's LACP system priority	IC (Ethernet)
lacp admin-key	Configures an port channel's administration key	IC (Port Channel)
Trunk Status Display Commands		
show interfaces status port-channel	Shows trunk information	NE, PE
show lacp	Shows LACP information	PE

Guidelines for Creating Trunks

General Guidelines

- Finish configuring trunks before you connect the corresponding network cables between switches to avoid creating a loop.
- A trunk can have up to 8 ports.
- The ports at both ends of a connection must be configured as trunk ports.
- All ports in a trunk must be configured in an identical manner, including communication mode (i.e., speed and duplex mode), VLAN assignments, and CoS settings.

- Any of the Gigabit ports on the front panel can be trunked together, including ports of different media types.
- All the ports in a trunk have to be treated as a whole when moved from/to, added or deleted from a VLAN via the specified port-channel.
- STP, VLAN, and IGMP settings can only be made for the entire trunk via the specified port-channel.

Dynamically Creating a Port Channel

Ports assigned to a common port channel must meet the following criteria:

- Ports must have the same LACP system priority.
- Ports must have the same port admin key (Ethernet Interface).
- If the port channel admin key (**lacp admin key** - Port Channel) is not set when a channel group is formed (i.e., it has the null value of 0), this key is set to the same value as the port admin key (**lacp admin key** - Ethernet Interface) used by the interfaces that joined the group.
- However, if the port channel admin key is set, then the port admin key must be set to the same value for a port to be allowed to join a channel group.
- If a link goes down, LACP port priority is used to select the backup link.

channel-group

This command adds a port to a trunk. Use the **no** form to remove a port from a trunk.

Syntax

channel-group *channel-id*

no channel-group

channel-id - Trunk index (Range: 1-12)

Default Setting

The current port will be added to this trunk.

Command Mode

Interface Configuration (Ethernet)

Command Usage

- When configuring static trunks, the switches must comply with the Cisco EtherChannel standard.
- Use **no channel-group** to remove a port group from a trunk.
- Use no interface port-channel to remove a trunk from the switch.

Example

The following example creates trunk 1 and then adds port 11:

```
SSE-G2252(config)#interface port-channel 1
SSE-G2252(config-if)#exit
SSE-G2252(config)#interface ethernet 1/11
SSE-G2252(config-if)#channel-group 1
SSE-G2252(config-if)#
```

lacp

This command enables 802.3ad Link Aggregation Control Protocol (LACP) for the current interface. Use the **no** form to disable it.

Syntax

[**no**] **lacp**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

- The ports on both ends of an LACP trunk must be configured for full duplex, either by forced mode or auto-negotiation.
- A trunk formed with another switch using LACP will automatically be assigned the next available port-channel ID.
- If the target switch has also enabled LACP on the connected ports, the trunk will be activated automatically.
- If more than eight ports attached to the same target switch have LACP enabled, the additional ports will be placed in standby mode, and will only be enabled if one of the active links fails.

Example

The following shows LACP enabled on ports 10-12. Because LACP has also been enabled on the ports at the other end of the links, the show interfaces status port-channel 1 command shows that Trunk1 has been established.

```
SSE-G2252(config)#interface ethernet 1/10
SSE-G2252(config-if)#lacp
SSE-G2252(config-if)#interface ethernet 1/11
SSE-G2252(config-if)#lacp
SSE-G2252(config-if)#interface ethernet 1/12
SSE-G2252(config-if)#lacp
SSE-G2252(config-if)#end
SSE-G2252#show interfaces status port-channel 1
Information of Trunk 1
 Basic Information:
  Port Type              : 100TX
  MAC Address            : 12-34-12-34-12-3F
Configuration:
  Name                   :
  Port Admin             : Up
  Speed-duplex           : Auto
  Capabilities           : 10half, 10full, 100half, 100full
  Broadcast Storm        : Disabled
  Broadcast Storm Limit  : 64 Kbits/second
  Flow Control           : Disabled
  Media Type             : Copper forced
  Giga PHY Mode          : Master
  Max MAC Count          : 0
 Current status:
  Created By             : LACP
  Link Status            : Up
  Port Operation Status  : Up
  Operation Speed-duplex : 100full
  Flow Control Type      : None
  Member Ports           : Eth1/10, Eth1/11, Eth1/12,
SSE-G2252#
```

lacp admin-key (Ethernet Interface)

This command configures a port's LACP administration key. Use the **no** form to restore the default setting.

Syntax

lacp {**actor** | **partner**} **admin-key** *key*

no lacp {**actor** | **partner**} **admin-key**

actor - The local side an aggregate link.

partner - The remote side of an aggregate link.

key - The port admin key must be set to the same value for ports that belong to the same link aggregation group (LAG). (Range: 0-65535)

Default Setting

0

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Ports are only allowed to join the same LAG if (1) the LACP system priority matches, (2) the LACP port admin key matches, and (3) the LACP port channel key matches (if configured).
- If the port channel admin key (**lacp admin key** - Port Channel) is not set when a channel group is formed (i.e., it has the null value of 0), this key is set to the same value as the port admin key (**lacp admin key** - Ethernet Interface) used by the interfaces that joined the group.
- Once the remote side of a link has been established, LACP operational settings are already in use on that side. Configuring LACP settings for the partner only applies to its administrative state, not its operational state.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#lacp actor admin-key 120
SSE-G2252(config-if)#
```

lacp port-priority

This command configures LACP port priority. Use the **no** form to restore the default setting.

Syntax

lacp {**actor** | **partner**} **port-priority** *priority*

no lacp {**actor** | **partner**} **port-priority**

actor - The local side an aggregate link.

partner - The remote side of an aggregate link.

priority - LACP port priority is used to select a backup link. (Range: 0-65535)

Default Setting

32768

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Setting a lower value indicates a higher effective priority.
- If an active port link goes down, the backup port with the highest priority is selected to replace the downed link. However, if two or more ports have the same LACP port priority, the port with the lowest physical port number will be selected as the backup port.
- Once the remote side of a link has been established, LACP operational settings are already in use on that side. Configuring LACP settings for the partner only applies to its administrative state, not its operational state, and will only take effect the next time an aggregate link is established with the partner.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#lacp actor port-priority 128
```

lacp system-priority

This command configures a port's LACP system priority. Use the **no** form to restore the default setting.

Syntax

lacp {**actor** | **partner**} **system-priority** *priority*

no lacp {**actor** | **partner**} **system-priority**

actor - The local side an aggregate link.

partner - The remote side of an aggregate link.

priority - This priority is used to determine link aggregation group (LAG) membership, and to identify this device to other switches during LAG negotiations. (Range: 0-65535)

Default Setting

32768

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Port must be configured with the same system priority to join the same LAG.
- System priority is combined with the switch's MAC address to form the LAG identifier. This identifier is used to indicate a specific LAG during LACP negotiations with other systems.
- Once the remote side of a link has been established, LACP operational settings are already in use on that side. Configuring LACP settings for the partner only applies to its administrative state, not its operational state, and will only take effect the next time an aggregate link is established with the partner.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#lacp actor system-priority 3
SSE-G2252(config-if)#
```

lacp admin-key (Port Channel)

This command configures a port channel's LACP administration key string. Use the **no** form to restore the default setting.

Syntax

lacp admin-key *key*

no lacp admin-key

key - The port channel admin key is used to identify a specific link aggregation group (LAG) during local LACP setup on this switch. (Range: 0-65535)

Default Setting

0

Command Mode

Interface Configuration (Port Channel)

Command Usage

- Ports are only allowed to join the same LAG if (1) the LACP system priority matches, (2) the LACP port admin key matches, and (3) the LACP port channel key matches (if configured).
- If the port channel admin key (**lacp admin key** - Port Channel) is not set when a channel group is formed (i.e., it has the null value of 0), this key is set to the same value as the port admin key (**lacp admin key** - Ethernet Interface) used by the interfaces that joined the group. Note that when the LAG is no longer used, the port channel admin key is reset to 0.

Example

```
SSE-G2252(config)#interface port-channel 1
SSE-G2252(config-if)#lacp admin-key 3
SSE-G2252(config-if)#
```

show lacp

This command displays LACP information.

Syntax

show lacp [*port-channel*] {**counters** | **internal** | **neighbors** | **sys-id**}

port-channel - Local identifier for a link aggregation group. (Range: 1-12)

counters - Statistics for LACP protocol messages.

internal - Configuration settings and operational state for local side.

neighbors - Configuration settings and operational state for remote side.

sys-id - Summary of system priority and MAC address for all channel groups.

Default Setting

Port Channel: all

Command Mode

Privileged Exec

Example

```
SSE-G2252#show lacp 1 counters
Port Channel: 1
---------------------------------------------------------------
Eth 1/ 2
---------------------------------------------------------------
  LACPDUs Sent         : 12
  LACPDUs Received     : 6
  Marker Sent          : 0
  Marker Received      : 0
  LACPDUs Unknown Pkts : 0
  LACPDUs Illegal Pkts : 0
.
.
.
```

Table 28-2. show lacp counters - Display Description

Field	Description
LACPDUs Sent	Number of valid LACPDUs transmitted from this channel group.
LACPDUs Received	Number of valid LACPDUs received on this channel group.
Marker Sent	Number of valid Marker PDUs transmitted from this channel group.
Marker Received	Number of valid Marker PDUs received by this channel group.
LACPDUs Unknown Pkts	Number of frames received that either (1) Carry the Slow Protocols Ethernet Type value, but contain an unknown PDU, or (2) are addressed to the Slow Protocols group MAC Address, but do not carry the Slow Protocols Ethernet Type.
LACPDUs Illegal Pkts	Number of frames that carry the Slow Protocols Ethernet Type value, but contain a badly formed PDU or an illegal value of Protocol Subtype.

```
SSE-G2252#show lacp 1 internal
Port Channel : 1
------------------------------------------------------------------------------
Oper Key  : 3
Admin Key : 0
Eth 1/ 1
------------------------------------------------------------------------------
  LACPDUs Internal     : 30 seconds
  LACP System Priority : 32768
  LACP Port Priority   : 32768
  Admin Key            : 3
  Oper Key             : 3
  Admin State          : defaulted, aggregation, long timeout,
LACP-activity
  Oper State           : distributing, collecting, synchronization,
                         aggregation, long timeout, LACP-activity
.
.
.
```

Table 28-3. show lacp internal - Display Description

Field	Description
Oper Key	Current operational value of the key for the aggregation port.
Admin Key	Current administrative value of the key for the aggregation port.
LACPDUs Internal	Number of seconds before invalidating received LACPDU information.
LACP System Priority	LACP system priority assigned to this port channel.
LACP Port Priority	LACP port priority assigned to this interface within the channel group.
Admin State, Oper State	Administrative or operational values of the actor's state parameters: Expired – The actor's receive machine is in the expired state; Defaulted – The actor's receive machine is using defaulted operational partner information, administratively configured for the partner. Distributing – If false, distribution of outgoing frames on this link is disabled; i.e., distribution is currently disabled and is not expected to be enabled in the absence of administrative changes or changes in received protocol information. Collecting – Collection of incoming frames on this link is enabled; i.e., collection is currently enabled and is not expected to be disabled in the absence of administrative changes or changes in received protocol information. Synchronization – The System considers this link to be IN_SYNC; i.e., it has been allocated to the correct Link Aggregation Group, the group has been associated with a compatible Aggregator, and the identity of the Link Aggregation Group is consistent with the System ID and operational Key information transmitted. Aggregation – The system considers this link to be aggregatable; i.e., a potential candidate for aggregation. Long timeout – Periodic transmission of LACPDUs uses a slow transmission rate. LACP-Activity – Activity control value with regard to this link. (0: Passive; 1: Active)

```
SSE-G2252#show lacp 1 neighbors
Port Channel 1 neighbors
------------------------------------------------------------------------------
Eth 1/ 1
------------------------------------------------------------------------------
  Partner Admin System ID   : 32768, 00-00-00-00-00-00
  Partner Oper System ID    : 32768, 00-12-CF-61-24-2F
  Partner Admin Port Number : 1
  Partner Oper Port Number  : 1
  Port Admin Priority       : 32768
  Port Oper Priority        : 32768
  Admin Key                 : 0
  Oper Key                  : 3
  Admin State:               defaulted, distributing, collecting,
                             synchronization, long timeout,
  Oper State:                distributing, collecting, synchronization,
                             aggregation, long timeout, LACP-activity
.
.
.
```

Table 28-4. show lacp neighbors - Display Description

Field	Description
Partner Admin System ID	LAG partner's system ID assigned by the user.
Partner Oper System ID	LAG partner's system ID assigned by the LACP protocol.
Partner Admin Port Number	Current administrative value of the port number for the protocol Partner.
Partner Oper Port Number	Operational port number assigned to this aggregation port by the port's protocol partner.
Port Admin Priority	Current administrative value of the port priority for the protocol partner.
Port Oper Priority	Priority value assigned to this aggregation port by the partner.
Admin Key	Current administrative value of the Key for the protocol partner.
Oper Key	Current operational value of the Key for the protocol partner.
Admin State	Administrative values of the partner's state parameters. (See preceding table.)
Oper State	Operational values of the partner's state parameters. (See preceding table.)

```
 SSE-G2252#show lacp sysid
Port Channel     System Priority    System MAC Address
--------------------------------------------------------------------------------
            1              32768     00-30-F1-8F-2C-A7
            2              32768     00-30-F1-8F-2C-A7
            3              32768     00-30-F1-8F-2C-A7
            4              32768     00-30-F1-8F-2C-A7
            5              32768     00-30-F1-8F-2C-A7
            6              32768     00-30-F1-8F-2C-A7
            7              32768     00-30-F1-D4-73-A0
            8              32768     00-30-F1-D4-73-A0
            9              32768     00-30-F1-D4-73-A0
           10              32768     00-30-F1-D4-73-A0
           11              32768     00-30-F1-D4-73-A0
           12              32768     00-30-F1-D4-73-A0
.
.
.
```

Table 28-5. show lacp sysid - Display Description

Field	Description
Channel group	A link aggregation group configured on this switch.
System Priority[a]	LACP system priority for this channel group.
System MAC Address*	System MAC address.

a. The LACP system priority and system MAC address are concatenated to form the LAG system ID.

Notes

Chapter 29
Power Over Ethernet Commands

The commands in this group control the power that can be delivered to attached PoE devices through RJ-45 ports 1-48 on the SSE-G2252P.

The switch's power management enables total switch power and individual port power to be controlled within a configured power budget. Port power can be automatically turned on and off for connected devices, and a per-port power priority can be set so that the switch never exceeds its allocated power budget. When a device is connected to a switch port, its power requirements are detected by the switch before power is supplied. If the power required by a device exceeds the power budget of the port or the whole switch, power is not supplied.

Table 29-1. PoE Commands

Command	Function	Mode
power inline compatible	Provides power to pre-standard PoE devices	GC
power inline	Turns power on and off for specific ports	IC
power inline maximum allocation	Sets the maximum power available to specific switch ports	IC
power inline priority	Sets the priority for power supplied to specific ports	IC
power inline time-range	Binds a time-range to a port during which PoE is supplied	IC
show power inline status	Displays the current status of power management on specific ports or all ports	PE
show power inline time-range	Shows the time-range and current status for specific ports or for all ports	PE
show power poe	Displays the current status of power management for switch	PE

power inline compatible

This command allows the switch to detect and provide power to powered devices that were designed prior to the IEEE 802.3af PoE standard. Use the **no** form to disable this feature.

Syntax

[**no**] **power inline compatible**

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

- The switch automatically detects attached PoE devices by periodically transmitting test voltages that over the Fast Ethernet or Gigabit Ethernet copper-media ports. When an IEEE 802.3af or 802.3at compatible device is plugged into one of these ports, the powered device reflects the test voltage back to the switch, which may then turn on the power to this device. When the **power inline compatible** command is used, this switch can detect IEEE 802.3af or 802.3at compliant devices and the more recent 802.3af non-compliant devices that also reflect the test voltages back to the switch. It cannot detect other legacy devices that do not reflect back the test voltages.
- For legacy devices to be supported by this switch, they must be able to accept power over the data pairs connected to the 10/100BASE-TX ports.

Example

```
SSE-G2252P(config)#power inline compatible
SSE-G2252P(config)#end
SSE-G2252P#show power inline status
Unit: 1
Compatible  mode : Enabled
                   Time           Max      Used
Interface Admin    Range    Oper Power    Power    Priority
--------- -------- -------- ---- -------- -------- --------
Eth 1/ 1  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/ 2  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/ 3  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/ 4  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/ 5  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/ 6  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/ 7  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/ 8  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/ 9  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/10  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/11  Enabled   --       Off 34200 mW     0 mW  Low
Eth 1/12  Enabled   --       Off 34200 mW     0 mW  Low
.
.
.
```

power inline

This command instructs the switch to automatically detect if a PoE-compliant device is connected to the specified port, and turn power on or off accordingly. Use the **no** form to turn off power for a port, or the **no** form with the time-range keyword to remove the time range settings.

Syntax

power inline [**time-range** *time-range-name]*

no power inline [**time-range**]

time-range-name - Name of the time range.
(Range: 1-30 characters)

Default Setting

Detection is enabled for PoE-compliant devices.

Command Mode

Interface Configuration (Ethernet ports 1-48)

Command Usage

- The switch only provides power to the Fast Ethernet or Gigabit Ethernet copper-media ports.
- When detection is enabled for PoE-compliant devices, power is automatically supplied when a device is detected on the port, providing that the power demanded does not exceed the port's power budget or the switch's power budget.

Example

```
SSE-G2252P(config)#interface ethernet 1/1
SSE-G2252P(config-if)#power inline
SSE-G2252P(config-if)#exit
SSE-G2252P(config)#interface ethernet 1/2
SSE-G2252P(config-if)#no power inline
SSE-G2252P(config-if)#
```

Related Commands

"time-range" on page 21-60

power inline maximum allocation

This command limits the power allocated to specific ports. Use the **no** form to restore the default setting.

Syntax

power inline maximum allocation *milliwatts*

no power inline maximum allocation

milliwatts - The maximum power budget for the port. (Range: 3000 - 34200 milliwatts)

Default Setting

34200 milliwatts

Command Mode

Interface Configuration (Ethernet ports 1-48)

Command Usage

- All the RJ-45 ports support the IEEE802.3at-2009 PoE standard. The total PoE power delivered by all ports cannot exceed the 400W power budget. This means that up to 11 ports can supply a maximum 34.2W of power simultaneously to connected devices (802.3at), up to 25 ports can supply up to 15.4W (802.3af), or all 48 ports can supply up to 7.5W (802.3af).
- If a device is connected to a switch port and the switch detects that it requires more than the maximum power allocated to the port or to the overall switch, no power is supplied to the device (i.e., port power remains off).

Example

```
SSE-G2252P(config)#interface ethernet 1/1
SSE-G2252P(config-if)#power inline maximum allocation 8000
SSE-G2252P(config-if)#
```

power inline priority

This command sets the power priority for specific ports. Use the **no** form to restore the default setting.

Syntax

power inline priority *priority*

no power inline priority

priority - The power priority for the port. Options: 1 (critical), 2 (high), or 3 (low)

Default Setting

3 (low)

Command Mode

Interface Configuration

Command Usage

- If the power demand from devices connected to the switch exceeds the power budget setting as determined during bootup, the switch uses port power priority settings to control the supplied power. For example:
  - A device connected to a low-priority port that causes the switch to exceed its budget is not supplied power.
  - If a device is connected to a critical or high-priority port and causes the switch to exceed its budget, port power is still be turned on if the switch can drop power to one or more lower-priority ports and keep within its budget.

    Power will be dropped from low-priority ports in sequence starting from port number 1.
  - If sufficient power cannot be freed up for a critical or high-priority port by turning off power to lower-priority ports, power will not be supplied to the newly connected device.
- If a device is connected to a port after the switch has finished booting up and would cause the switch to exceed its budget, power will not be provided to that port regardless of its priority setting.

NOTE: If priority is not set for any ports, and there is not sufficient power to supply all of the ports, power is denied sequentially to PSE chip sets 1-4:

PSE#1: 1,0,3,2,5,4,7,6,9,8,11,10

PSE#2: 13,12,15,14,17,16 19,18,21,20,23,22,25

PSE#3: 24,27,26,29,28,31,30,33,32,35,34,37

PSE#4: 36,39,38,41,40,43,42,45,44,47,46

Example

```
SSE-G2252P(config)#interface ethernet 1/1
SSE-G2252P(config-if)#power inline priority 2
SSE-G2252P(config-if)#
```

power inline time-range

This command binds a time-range to a port during which PoE is supplied to the attached device. Use the **no** form to remove this binding.

Syntax

power inline time-range *time-range-name*

no power inline time-range

time-range-name - Name of the time range. (Range: 1-30 characters)

Default Setting

None

Command Mode

Interface Configuration

Example

```
SSE-G2252P(config)#interface ethernet 1/1
SSE-G2252P(config-if)#power inline time-range rd
SSE-G2252P(config-if)#
```

Related Commands

"time-range" on page 21-60

show power inline status

This command displays the current power status for all ports or for specific ports.

Syntax

show power inline status [*interface*]

interface

ethernet

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-48)

Command Mode

Privileged Exec

Example

```
SSE-G2252P#show power inline status
```

```
Unit: 1
Compatible  mode : Enabled
                   Time           Max       Used
Interface Admin    Range    Oper Power     Power     Priority
--------- -------- -------- ---- --------- --------- --------
Eth 1/ 1  Enabled   --       Off 34200 mW      0 mW  Low
Eth 1/ 2  Enabled   --       Off 34200 mW      0 mW  Low
Eth 1/ 3  Enabled   --       Off 34200 mW   7505 mW  Low
Eth 1/ 4  Enabled   --       Off 34200 mW      0 mW  Low
Eth 1/ 5  Enabled   --       Off 34200 mW      0 mW  Low
Eth 1/ 6  Enabled   --       Off 34200 mW      0 mW  Low
Eth 1/ 7  Enabled   --       Off 15400 mW   8597 mW  Low
Eth 1/ 8  Enabled   --       Off 15400 mW      0 mW  Low
Eth 1/ 9  Enabled   --       Off 15400 mW      0 mW  Low
Eth 1/10  Enabled   --       Off 15400 mW      0 mW  Low
Eth 1/11  Enabled   --       Off 15400 mW      0 mW  Low
Eth 1/12  Enabled   --       Off 15400 mW      0 mW  Low
.
.
.
```

Table 29-2. show power inline status - display description

Field	Description
Admin	The power mode set on the port (see power inline)
Oper	The current operating power status (displays on or off)
Power (mWatt)	The maximum power allocated to this port (see power inline maximum allocation)
Power (used)	The current power consumption on the port in milliwatts
Priority	The port's power priority setting (see power inline priority)

show power inline time-range

This command displays the time-range and current status for specific ports or for all ports.

Syntax

show power inline time-range *time-range-name* [*interface*]

time-range-name - Name of the time range.
(Range: 1-30 characters)

interface

ethernet

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-48)

Command Mode

Privileged Exec

Example

```
SSE-G2252P#show power inline time-range ethernet 1/5
Interface Time Range Name  Status
--------- --------------- --------
Eth 1/ 5  r&d             Inactive
SSE-G2252P#
```

Related Commands

"power inline" on page 29-3

show power poe

Use this command to display the current power status for the switch.

Command Mode

Privileged Exec

Example

```
SSE-G2252P#show power poe
Unit 1 PoE Status
 PoE Maximum Available Power  : 400 Watts
 System Operation Status      : Off
 PoE Power Consumption        : 0 Watts
 Software Version             : Microsemi SDK V1.0.4
SSE-G2252P#
```

Table 29-3. show power mainpower - display description

Field	Description
PoE Maximum Available Power	The available power budget for the switch
System Operation Status	The current operating power status (displays on or off)
PoE Power Consumption	The current power consumption on the switch in watts
Software Version	The version of software running on the PoE controller subsystem in the switch.

Notes

Chapter 30
Port Mirroring Commands

Data can be mirrored from a local port on the same switch or from a remote port on another switch for analysis at the target port using software monitoring tools or a hardware probe. This switch supports the following mirroring modes.

Table 30-1. Port Mirroring Commands

Command	Function
Local Port Mirroring	Mirrors data to another port for analysis without affecting the data passing through or the performance of the monitored port
RSPAN Mirroring	Mirrors data from remote switches over a dedicated VLAN

30-1 Local Port Mirroring Commands

This section describes how to mirror traffic from a source port to a target port.

Table 30-2. Mirror Port Commands

Command	Function	Mode
port monitor	Configures a mirror session	IC
show port monitor	Shows the configuration for a mirror port	PE

port monitor

This command configures a mirror session. Use the **no** form to clear a mirror session.

Syntax

port monitor [*interface* [**rx** | **tx** | **both**] | **vlan** *vlan-id* | **mac-address** *mac-address*]

no port monitor *interface*

interface

ethernet *unit*/*port* (source port)

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

rx - Mirror received packets.

tx - Mirror transmitted packets.

both - Mirror both received and transmitted packets.

vlan-id - VLAN ID (Range: 1-4093)

mac-address - MAC address in the form of xx-xx-xx-xx-xx-xx or xxxxxxxxxxxx.

Default Setting

- No mirror session is defined.
- When enabled for an interface, default mirroring is for both received and transmitted packets.
- When enabled for a VLAN or a MAC address, mirroring is restricted to received packets.

Command Mode

Interface Configuration (Ethernet, destination port)

Command Usage

- You can mirror traffic from any source port or trunk to a destination port for real-time analysis. You can then attach a logic analyzer or RMON probe to the destination port and study the traffic crossing the source port or trunk in a completely unobtrusive manner.
- Set the destination port by specifying an Ethernet interface with the interface configuration command, and then use the **port monitor** command to specify the source of the traffic to mirror.

- When mirroring traffic from a port or trunk, the mirror port/trunk and monitor port speeds should match, otherwise traffic may be dropped from the monitor port. When mirroring traffic from a VLAN, traffic may also be dropped under heavy loads.
- When VLAN mirroring and port or trunk mirroring are both enabled, the target port can receive a mirrored packet twice; once from the source mirror port or trunk and again from the source mirror VLAN.
- When mirroring traffic from a MAC address, ingress traffic with the specified source address entering any port in the switch, other than the target port, will be mirrored to the destination port.
- Spanning Tree BPDU packets are not mirrored to the target port.
- You can create multiple mirror sessions, but all sessions must share the same destination port.

Example

The following example configures the switch to mirror all packets from port 6 to 11:

```
SSE-G2252(config)#interface ethernet 1/11
SSE-G2252(config-if)#port monitor ethernet 1/6 both
SSE-G2252(config-if)#
```

show port monitor

This command displays mirror information.

Syntax

show port monitor [*interface* | **vlan** *vlan-id* | **mac-address** *mac-address*]

interface - **ethernet** *unit*/*port* (source port)

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

vlan-id - VLAN ID (Range: 1-4093)

mac-address - MAC address in the form of xx-xx-xx-xx-xx-xx or xxxxxxxxxxxx.

Default Setting

Shows all sessions.

Command Mode

Privileged Exec

Command Usage

This command displays the currently configured source port, destination port, and mirror mode (i.e., RX, TX, RX/TX).

Example

The following shows mirroring configured from port 6 to port 11:

```
SSE-G2252(config)#interface ethernet 1/11
SSE-G2252(config-if)#port monitor ethernet 1/6
SSE-G2252(config-if)#end
SSE-G2252#show port monitor
Port Mirroring
-------------------------------------
 Destination Port (listen port): Eth1/11
 Source Port (monitored port)   : Eth1/ 6
 Mode                          :RX/TX
SSE-G2252#
```

30-2 RSPAN Mirroring Commands

Remote Switched Port Analyzer (RSPAN) allows you to mirror traffic from remote switches for analysis on a local destination port.

Table 30-3. RSPAN Commands

Command	Function	Mode
vlan rspan	Creates a VLAN dedicated to carrying RSPAN traffic	VC
rspan source	Specifies the source port and traffic type to be mirrored	GC
rspan destination	Specifies the destination port to monitor the mirrored traffic	GC
rspan remote vlan	Specifies the RSPAN VLAN, switch role (source, intermediate or destination), and the uplink ports	GC
no rspan session	Deletes a configured RSPAN session	GC
show rspan	Displays the configuration settings for an RSPAN session	PE

Configuration Guidelines

Take the following steps to configure an RSPAN session:

1. Use the vlan rspan command to configure a VLAN to use for RSPAN. (Default VLAN 1 and switch cluster VLAN 4093 are prohibited.)
2. Use the rspan source command to specify the interfaces and the traffic type (RX, TX or both) to be monitored.
3. Use the rspan destination command to specify the destination port for the traffic mirrored by an RSPAN session.
4. Use the rspan remote vlan command to specify the VLAN to be used for an RSPAN session, to specify the switch's role as a source, intermediate relay, or destination of the mirrored traffic, and to configure the uplink ports designated to carry this traffic.

RSPAN Limitations

The following limitations apply to the use of RSPAN on this switch:

- *RSPAN Ports* – Only ports can be configured as an RSPAN source, destination, or uplink; static and dynamic trunks are not allowed. A port can only be configured as one type of RSPAN interface – source, destination, or uplink. Also, note that the source port and destination port cannot be configured on the same switch.

  Only 802.1Q trunk or hybrid (i.e., general use) ports can be configured as an RSPAN uplink or destination port – access ports are not allowed (see switchport mode).

- *Local/Remote Mirror* – The destination of a local mirror session (created with the port monitor command) cannot be used as the destination for RSPAN traffic.

  Only two mirror sessions are allowed. Both sessions can be allocated to remote mirroring, unless local mirroring is enabled (which is limited to a single session).

- *Spanning Tree* – If the spanning tree is disabled, BPDUs will not be flooded onto the RSPAN VLAN.

  MAC address learning is not supported on RSPAN uplink ports when RSPAN is enabled on the switch. Therefore, even if spanning tree is enabled after RSPAN has been configured, MAC address learning will still not be re-started on the RSPAN uplink ports.

- *IEEE 802.1X* – RSPAN and 802.1X are mutually exclusive functions. When 802.1X is enabled globally, RSPAN uplink ports cannot be configured, even though RSPAN source and destination ports can still be configured. When RSPAN uplink ports are enabled on the switch, 802.1X cannot be enabled globally.

  RSPAN uplink ports cannot be configured to use IEEE 802.1X Port Authentication, but RSPAN source ports and destination ports can be configured to use it

- *Port Security* – If port security is enabled on any port, that port cannot be set as an RSPAN uplink port, even though it can still be configured as an RSPAN source or destination port. Also, when a port is configured as an RSPAN uplink port, port security cannot be enabled on that port.

rspan source

Use this command to specify the source port and traffic type to be mirrored remotely. Use the **no** form to disable RSPAN on the specified port, or with a traffic type keyword to disable mirroring for the specified type.

Syntax

[**no**] **rspan session** *session-id* **source interface** *interface-list*
[**rx** | **tx** | **both**]

session-id – A number identifying this RSPAN session (Range: 1-2). Only two mirror sessions are allowed, including both local and remote mirroring. If local mirroring is enabled with the port monitor command, then there is only one session available for RSPAN.

interface-list – One or more source ports. Use a hyphen to indicate a consecutive list of ports or a comma between non-consecutive ports.

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

rx - Mirror received packets.

tx - Mirror transmitted packets.

both - Mirror both received and transmitted packets.

Default Setting

Both TX and RX traffic is mirrored

Command Mode

Global Configuration

Command Usage

- One or more source ports can be assigned to the same RSPAN session, either on the same switch or on different switches.
- Only ports can be configured as an RSPAN source – static and dynamic trunks are not allowed.
- The source port and destination port cannot be configured on the same switch.

Example

The following example configures the switch to mirror received packets from port 2 and 3:

```
SSE-G2252(config)#rspan session 1 source interface ethernet 1/2
SSE-G2252(config)#rspan session 1 source interface ethernet 1/3
SSE-G2252(config)#
```

rspan destination

Use this command to specify the destination port to monitor the mirrored traffic. Use the **no** form to disable RSPAN on the specified port.

Syntax

rspan session *session-id* **destination interface** *interface* [**tagged** | **untagged**]

no rspan session *session-id* **destination interface** *interface*

session-id – A number identifying this RSPAN session (Range: 1-2). Only two mirror sessions are allowed, including both local and remote mirroring. If local mirroring is enabled with the port monitor command, then there is only one session available for RSPAN.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

tagged - Traffic exiting the destination port carries the RSPAN VLAN tag.

untagged - Traffic exiting the destination port is untagged.

Default Setting

Traffic exiting the destination port is untagged.

Command Mode

Global Configuration

Command Usage

- Only one destination port can be configured on the same switch per session, but a destination port can be configured on more than one switch for the same session.
- Only 802.1Q trunk or hybrid (i.e., general use) ports can be configured as an RSPAN destination port – access ports are not allowed (see switchport mode).
- Only ports can be configured as an RSPAN destination – static and dynamic trunks are not allowed.
- The source port and destination port cannot be configured on the same switch.
- A destination port can still send and receive switched traffic, and participate in any Layer 2 protocols to which it has been assigned.

Example

The following example configures port 4 to receive mirrored RSPAN traffic:

```
SSE-G2252(config)#rspan session 1 destination interface ethernet 1/2
SSE-G2252(config)#
```

rspan remote vlan

Use this command to specify the RSPAN VLAN, switch role (source, intermediate or destination), and the uplink ports. Use the **no** form to disable the RSPAN on the specified VLAN.

Syntax

[**no**] **rspan session** *session-id* **remote vlan** *vlan-id*
{**source** | **intermediate** | **destination**} **uplink** *interface*

session-id – A number identifying this RSPAN session (Range: 1-2). Only two mirror sessions are allowed, including both local and remote mirroring. If local mirroring is enabled with the port monitor command, then there is only one session available for RSPAN.

vlan-id - ID of configured RSPAN VLAN (Range: 2-4092), Use the vlan rspan command to reserve a VLAN for RSPAN mirroring before enabling RSPAN with this command.

source - Specifies this device as the source of remotely mirrored traffic.

intermediate - Specifies this device as an intermediate switch, transparently passing mirrored traffic from one or more sources to one or more destinations.

destination - Specifies this device as a switch configured with a destination port which is to receive mirrored traffic for this session.

uplink - A port configured to receive or transmit remotely mirrored traffic.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Only 802.1Q trunk or hybrid (i.e., general use) ports can be configured as an RSPAN uplink port – access ports are not allowed (see switchport mode).
- Only one uplink port can be configured on a source switch, but there is no limitation on the number of uplink ports configured on an intermediate or destination switch.
- Only destination and uplink ports will be assigned by the switch as members of this VLAN. Ports cannot be manually assigned to an RSPAN VLAN with the switchport allowed vlan command. Nor can GVRP dynamically add port members to an RSPAN VLAN. Also, note that the show vlan command will not display any members for an RSPAN VLAN, but will only show configured RSPAN VLAN identifiers.

Example

The following example enables RSPAN on VLAN 2, specifies this device as an RSPAN destination switch, and the uplink interface as port 3:

```
SSE-G2252(config)#rspan session 1 remote vlan 2 destination
uplink ethernet 1/3
SSE-G2252(config)#
```

no rspan session

Use this command to delete a configured RSPAN session.

Syntax

no rspan session *session-id*

session-id – A number identifying this RSPAN session (Range: 1-2). Only two mirror sessions are allowed, including both local and remote mirroring. If local mirroring is enabled with the port monitor command, then there is only one session available for RSPAN.

Command Mode

Global Configuration

Command Usage

The **no rspan session** command must be used to disable an RSPAN VLAN before it can be deleted from the VLAN database (see the vlan command).

Example

```
SSE-G2252(config)#no rspan session 1
SSE-G2252(config)#
```

show rspan

Use this command to displays the configuration settings for an RSPAN session.

Syntax

show rspan session [*session-id*]

session-id – A number identifying this RSPAN session (Range: 1-2). Only two mirror sessions are allowed, including both local and remote mirroring. If local mirroring is enabled with the port monitor command, then there is only one session available for RSPAN.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show rspan session
RSPAN Session ID                : 1
Source Ports (mirrored ports)   : None
  RX Only                       : None
  TX Only                       : None
  BOTH                          : None
Destination Port (monitor port) : Eth 1/2
Destination Tagged Mode         : Untagged
Switch Role                     : Destination
RSPAN VLAN                      : 2
RSPAN Uplink Ports              : Eth 1/3
Operation Status                : Up
SSE-G2252#
```

Notes

Chapter 31
Rate Limit Commands

This function allows the network manager to control the maximum rate for traffic transmitted or received on an interface. Rate limiting is configured on interfaces at the edge of a network to limit traffic into or out of the network. Packets that exceed the acceptable amount of traffic are dropped.

Rate limiting can be applied to individual ports. When an interface is configured with this feature, the traffic rate will be monitored by the hardware to verify conformity. Non-conforming traffic is dropped.

Table 31-1. Rate Limit Commands

Command	Function	Mode
rate-limit	Configures the maximum input or output rate for an interface	IC

rate-limit

This command defines the rate limit for a specific interface. Use this command without specifying a rate to restore the default rate. Use the **no** form to restore the default status of disabled.

Syntax

rate-limit {**input** | **output**} [*rate*]

no rate-limit {**input** | **output**}

input – Input rate for specified interface

output – Output rate for specified interface

rate – Maximum value in Kbps.
(Range: 64-100000 Kbps for Fast Ethernet ports,
64-1000000 Kbps for Gigabit Ethernet ports)

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Using both rate limiting and storm control on the same interface may lead to unexpected results. For example, suppose broadcast storm control is set to 500 Kbps by the command "switchport broadcast packet-rate 500," and the rate limit is set to 20000 Kbps by the command "rate-limit input 20000" on a Fast Ethernet port. Since 20000 Kbps is 1/5 of line speed (100 Mbps), the received rate will actually be 100 Kbps, or 1/5 of the 500 Kbps limit set by the storm control command. It is therefore not advisable to use both of these commands on the same interface.
- See the description of effective rate limiting in the Command Usage under Section 10-1: "Rate Limiting" on page 10-1.

NOTE: Due to a chip limitation, the switch supports only one limit for both ingress rate limiting and storm control (including broadcast unknown unicast, multicast, and broadcast storms).

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#rate-limit input 64
SSE-G2252(config-if)#
```

Related Command

"show interfaces switchport" on page 27-16

Chapter 32
Automatic Traffic Control Commands

Automatic Traffic Control (ATC) configures bounding thresholds for broadcast and multicast storms which can be used to trigger configured rate limits or to shut down a port.

Table 32-1. ATC Commands

Command	Function	Mode
Threshold Commands		
auto-traffic-control apply-timer	Sets the time at which to apply the control response after ingress traffic has exceeded the upper threshold	GC
auto-traffic-control release-timer	Sets the time at which to release the control response after ingress traffic has fallen beneath the lower threshold	GC
auto-traffic-control[a]	Enables automatic traffic control for broadcast or multicast storms	IC (Port)
auto-traffic-control action	Sets the control action to limit ingress traffic or shut down the offending port	IC (Port)
auto-traffic-control alarm-clear-threshold	Sets the lower threshold for ingress traffic beneath which a cleared storm control trap is sent	IC (Port)
auto-traffic-control alarm-fire-threshold	Sets the upper threshold for ingress traffic beyond which a storm control response is triggered after the apply timer expires	IC (Port)
auto-traffic-control auto-control-release	Automatically releases a control response	IC (Port)
auto-traffic-control control-release	Manually releases a control response	IC (Port)
SNMP Trap Commands		
snmp-server enable port-traps atc broadcast-alarm-clear	Sends a trap when broadcast traffic falls beneath the lower threshold after a storm control response has been triggered	IC (Port)
snmp-server enable port-traps atc broadcast-alarm-fire	Sends a trap when broadcast traffic exceeds the upper threshold for automatic storm control	IC (Port)
snmp-server enable port-traps atc broadcast-control-apply	Sends a trap when broadcast traffic exceeds the upper threshold for automatic storm control and the apply timer expires	IC (Port)
snmp-server enable port-traps atc broadcast-control-release	Sends a trap when broadcast traffic falls beneath the lower threshold after a storm control response has been triggered and the release timer expires	IC (Port)
snmp-server enable port-traps atc multicast-alarm-clear	Sends a trap when multicast traffic falls beneath the lower threshold after a storm control response has been triggered	IC (Port)
snmp-server enable port-traps atc multicast-alarm-fire	Sends a trap when multicast traffic exceeds the upper threshold for automatic storm control	IC (Port)

Table 32-1. ATC Commands (Continued)

Command	Function	Mode
snmp-server enable port-traps atc multicast-control-apply	Sends a trap when multicast traffic exceeds the upper threshold for automatic storm control and the apply timer expires	IC (Port)
snmp-server enable port-traps atc multicast-control-release	Sends a trap when multicast traffic falls beneath the lower threshold after a storm control response has been triggered and the release timer expires	IC (Port)
ATC Display Commands		
show auto-traffic-control	Shows global configuration settings for automatic storm control	PE
show auto-traffic-control interface	Shows interface configuration settings and storm control status for the specified port	PE

a. Enabling automatic storm control on a port will disable hardware-level storm control on the same port if configured by the switchport packet-rate command.

auto-traffic-control apply-timer

This command sets the time at which to apply the control response after ingress traffic has exceeded the upper threshold. Use the **no** form to restore the default setting.

Syntax

auto-traffic-control {**broadcast** | **multicast**} **apply-timer** *seconds*

no auto-traffic-control {**broadcast** | **multicast**} **apply-timer**

broadcast - Specifies automatic storm control for broadcast traffic.

multicast - Specifies automatic storm control for multicast traffic.

seconds - The interval after the upper threshold has been exceeded at which to apply the control response. (Range: 1-300 seconds)

Default Setting

300 seconds

Command Mode

Global Configuration

Command Usage

After the apply timer expires, a control action may be triggered as specified by the auto-traffic-control action command and a trap message sent as specified by the snmp-server enable port-traps atc broadcast-control-apply command or snmp-server enable port-traps atc multicast-control-apply command.

Example

This example sets the apply timer to 200 seconds for all ports.

```
SSE-G2252(config)#auto-traffic-control broadcast apply-timer 200
SSE-G2252(config)#
```

auto-traffic-control release-timer

This command sets the time at which to release the control response after ingress traffic has fallen beneath the lower threshold. Use the **no** form to restore the default setting.

Syntax

auto-traffic-control {**broadcast** | **multicast**}
release-timer *seconds*

no auto-traffic-control {**broadcast** | **multicast**} **release-timer**

broadcast - Specifies automatic storm control for broadcast traffic.

multicast - Specifies automatic storm control for multicast traffic.

seconds - The time at which to release the control response after ingress traffic has fallen beneath the lower threshold. (Range: 1-900 seconds)

Default Setting

900 seconds

Command Mode

Global Configuration

Command Usage

This command sets the delay after which the control response can be terminated. The auto-traffic-control auto-control-release command must be used to enable or disable the automatic release of a control response of rate-limiting. To re-enable a port which has been shut down by automatic traffic control, you must manually re-enable the port using the auto-traffic-control control-release command.

Example

This example sets the release timer to 800 seconds for all ports.

```
SSE-G2252(config)#auto-traffic-control broadcast release-timer 800
SSE-G2252(config)#
```

auto-traffic-control

This command enables automatic traffic control for broadcast or multicast storms. Use the **no** form to disable this feature.

Syntax

[**no**] **auto-traffic-control** {**broadcast** | **multicast**}

broadcast - Specifies automatic storm control for broadcast traffic.

multicast - Specifies automatic storm control for multicast traffic.

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Automatic storm control can be enabled for either broadcast or multicast traffic. It cannot be enabled for both of these traffic types at the same time.
- Automatic storm control is a software level control function. Traffic storms can also be controlled at the hardware level using the switchport packet-rate command. However, only one of these control types can be applied to a port. Enabling automatic storm control on a port will disable hardware-level storm control on that port.

Example

This example enables automatic storm control for broadcast traffic on port 1.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#auto-traffic-control broadcast
SSE-G2252(config-if)#
```

auto-traffic-control action

This command sets the control action to limit ingress traffic or shut down the offending port. Use the **no** form to restore the default setting.

Syntax

auto-traffic-control {**broadcast** | **multicast**}
action {**rate-control** | **shutdown**}

no auto-traffic-control {**broadcast** | **multicast**} **action**

broadcast - Specifies automatic storm control for broadcast traffic.

multicast - Specifies automatic storm control for multicast traffic.

rate-control - If a control response is triggered, the rate of ingress traffic is limited based on the threshold configured by the auto-traffic-control alarm-clear-threshold command.

shutdown - If a control response is triggered, the port is administratively disabled. A port disabled by automatic traffic control can only be manually re-enabled.

Default Setting

rate-control

Command Mode

Interface Configuration (Ethernet)

Command Usage

- When the upper threshold is exceeded and the apply timer expires, a control response will be triggered based on this command.
- When the control response is set to rate limiting by this command, the rate limits are determined by the auto-traffic-control alarm-clear-threshold command.
- If the control response is to limit the rate of ingress traffic, it can be automatically terminated once the traffic rate has fallen beneath the lower threshold and the release timer has expired.
- If a port has been shut down by a control response, it will not be re-enabled by automatic traffic control. It can only be manually re-enabled using the auto-traffic-control control-release command.

Example

This example sets the control response for broadcast traffic on port 1.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#auto-traffic-control broadcast action shutdown
SSE-G2252(config-if)#
```

auto-traffic-control alarm-clear-threshold

This command sets the lower threshold for ingress traffic beneath which a control response for rate limiting will be released after the Release Timer expires, if so configured by the auto-traffic-control auto-control-release command. Use the **no** form to restore the default setting.

Syntax

auto-traffic-control {**broadcast** | **multicast**}
alarm-clear-threshold *threshold*

no auto-traffic-control {**broadcast** | **multicast**}
alarm-clear-threshold

broadcast - Specifies automatic storm control for broadcast traffic.

multicast - Specifies automatic storm control for multicast traffic.

threshold - The lower threshold for ingress traffic beneath which a cleared storm control trap is sent. (Range: 1-255 kilo-packets per second)

Default Setting

128 kilo-packets per second

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Once the traffic rate falls beneath the lower threshold, a trap message may be sent if configured by the snmp-server enable port-traps atc broadcast-alarm-clear command or snmp-server enable port-traps atc multicast-alarm-clear command.
- If rate limiting has been configured as a control response, it will be discontinued after the traffic rate has fallen beneath the lower threshold, and the release timer has expired. Note that if a port has been shut down by a control response, it will not be re-enabled by automatic traffic control. It can only be manually re-enabled using the auto-traffic-control control-release command.

Example

This example sets the clear threshold for automatic storm control for broadcast traffic on port 1.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#auto-traffic-control broadcast alarm-clear-threshold
155
SSE-G2252(config-if)#
```

auto-traffic-control alarm-fire-threshold

This command sets the upper threshold for ingress traffic beyond which a storm control response is triggered after the apply timer expires. Use the **no** form to restore the default setting.

Syntax

auto-traffic-control {**broadcast** | **multicast**}
alarm-fire-threshold *threshold*

no auto-traffic-control {**broadcast** | **multicast**}
alarm-fire-threshold

broadcast - Specifies automatic storm control for broadcast traffic.

multicast - Specifies automatic storm control for multicast traffic.

threshold - The upper threshold for ingress traffic beyond which a storm control response is triggered after the apply timer expires. (Range: 1-255 kilo-packets per second)

Default Setting

128 kilo-packets per second

Command Mode

Interface Configuration (Ethernet)

Command Usage

- Once the upper threshold is exceeded, a trap message may be sent if configured by the snmp-server enable port-traps atc broadcast-alarm-fire command or snmp-server enable port-traps atc multicast-alarm-fire command.
- After the upper threshold is exceeded, the control timer must first expire as configured by the auto-traffic-control apply-timer command before a control response is triggered if configured by the auto-traffic-control action command.

Example

This example sets the trigger threshold for automatic storm control for broadcast traffic on port 1.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#auto-traffic-control broadcast alarm-fire-threshold
255
SSE-G2252(config-if)#
```

auto-traffic-control auto-control-release

This command automatically releases a control response of rate-limiting after the time specified in the auto-traffic-control release-timer command has expired.

Syntax

auto-traffic-control {**broadcast** | **multicast**}
auto-control-release

broadcast - Specifies automatic storm control for broadcast traffic.

multicast - Specifies automatic storm control for multicast traffic.

Command Mode

Interface Configuration (Ethernet)

Command Usage

- This command can be used to automatically stop a control response of rate-limiting after the specified action has been triggered and the release timer has expired.
- To release a control response which has shut down a port after the specified action has been triggered and the release timer has expired, use the auto-traffic-control control-release command.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#auto-traffic-control broadcast auto-control-release
SSE-G2252(config-if)#
```

auto-traffic-control control-release

This command manually releases a control response.

Syntax

auto-traffic-control {**broadcast** | **multicast**} **control-release**

broadcast - Specifies automatic storm control for broadcast traffic.

multicast - Specifies automatic storm control for multicast traffic.

Command Mode

Interface Configuration (Ethernet)

Command Usage

This command can be used to manually stop a control response of rate-limiting or port shutdown any time after the specified action has been triggered.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#auto-traffic-control broadcast control-release
interface ethernet 1/1
SSE-G2252#(config-if)
```

snmp-server enable port-traps atc broadcast-alarm-clear

This command sends a trap when broadcast traffic falls beneath the lower threshold after a storm control response has been triggered. Use the **no** form to disable this trap.

Syntax

[**no**] **snmp-server enable port-traps atc broadcast-alarm-clear**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#snmp-server enable port-traps atc
broadcast-alarm-clear
SSE-G2252(config-if)#
```

Related Commands

"auto-traffic-control action" on page 32-4

"auto-traffic-control alarm-clear-threshold" on page 32-6

snmp-server enable port-traps atc broadcast-alarm-fire

This command sends a trap when broadcast traffic exceeds the upper threshold for automatic storm control. Use the **no** form to disable this trap.

Syntax

[**no**] **snmp-server enable port-traps atc broadcast-alarm-fire**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#snmp-server enable port-traps atc
broadcast-alarm-fire
SSE-G2252(config-if)#
```

Related Commands

"auto-traffic-control alarm-fire-threshold" on page 32-7

snmp-server enable port-traps atc broadcast-control-apply

This command sends a trap when broadcast traffic exceeds the upper threshold for automatic storm control and the apply timer expires. Use the **no** form to disable this trap.

Syntax

[**no**] **snmp-server enable port-traps atc broadcast-control-apply**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#snmp-server enable port-traps atc
broadcast-control-apply
SSE-G2252(config-if)#
```

Related Commands

"auto-traffic-control alarm-fire-threshold" on page 32-7

"auto-traffic-control apply-timer" on page 32-2

snmp-server enable port-traps atc broadcast-control-release

This command sends a trap when broadcast traffic falls beneath the lower threshold after a storm control response has been triggered and the release timer expires. Use the **no** form to disable this trap.

Syntax

[**no**] **snmp-server enable port-traps atc broadcast-control-release**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#snmp-server enable port-traps atc
broadcast-control-release
SSE-G2252(config-if)#
```

Related Commands

"auto-traffic-control alarm-clear-threshold" on page 32-6

"auto-traffic-control action" on page 32-4

"auto-traffic-control release-timer" on page 32-3

snmp-server enable port-traps atc multicast-alarm-clear

This command sends a trap when multicast traffic falls beneath the lower threshold after a storm control response has been triggered. Use the **no** form to disable this trap.

Syntax

[**no**] **snmp-server enable port-traps atc multicast-alarm-clear**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#snmp-server enable port-traps atc
multicast-alarm-clear
SSE-G2252(config-if)#
```

Related Commands

"auto-traffic-control action" on page 32-4

"auto-traffic-control alarm-clear-threshold" on page 32-6

snmp-server enable port-traps atc multicast-alarm-fire

This command sends a trap when multicast traffic exceeds the upper threshold for automatic storm control. Use the **no** form to disable this trap.

Syntax

[**no**] **snmp-server enable port-traps atc multicast-alarm-fire**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#snmp-server enable port-traps atc
multicast-alarm-fire
SSE-G2252(config-if)#
```

Related Commands

"auto-traffic-control alarm-fire-threshold" on page 32-7

snmp-server enable port-traps atc multicast-control-apply

This command sends a trap when multicast traffic exceeds the upper threshold for automatic storm control and the apply timer expires. Use the **no** form to disable this trap.

Syntax

[**no**] **snmp-server enable port-traps atc multicast-control-apply**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#snmp-server enable port-traps atc
multicast-control-apply
SSE-G2252(config-if)#
```

Related Commands

"auto-traffic-control alarm-fire-threshold" on page 32-7

"auto-traffic-control apply-timer" on page 32-2

snmp-server enable port-traps atc multicast-control-release

This command sends a trap when multicast traffic falls beneath the lower threshold after a storm control response has been triggered and the release timer expires. Use the **no** form to disable this trap.

Syntax

[**no**] **snmp-server enable port-traps atc multicast-control-release**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#snmp-server enable port-traps atc
multicast-control-release
SSE-G2252(config-if)#
```

Related Commands

"auto-traffic-control alarm-clear-threshold" on page 32-6

"auto-traffic-control action" on page 32-4

"auto-traffic-control release-timer" on page 32-3

show auto-traffic-control

This command shows global configuration settings for automatic storm control.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show auto-traffic-control

Storm-control: Broadcast
 Apply-timer (sec)   : 300
 release-timer (sec) : 900

Storm-control: Multicast
 Apply-timer(sec)    : 300
 release-timer(sec)  : 900
SSE-G2252#
```

show auto-traffic-control interface

This command shows interface configuration settings and storm control status for the specified port.

Syntax

show auto-traffic-control interface [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show auto-traffic-control interface ethernet 1/1
Eth 1/1 Information
------------------------------------------------------------------------------
Storm Control:              Broadcast                   Multicast
State:                      Disabled                    Disabled
Action:                     rate-control                rate-control
Auto Release Control:       Disabled                    Disabled
Alarm Fire Threshold(Kpps): 128                         128
Alarm Clear Threshold(Kpps):128                         128
Trap Storm Fire:            Disabled                    Disabled
Trap Storm Clear:           Disabled                    Disabled
Trap Traffic Apply:         Disabled                    Disabled
Trap Traffic Release:       Disabled                    Disabled

SSE-G2252#
```

Notes

Chapter 33
Address Table Commands

These commands are used to configure the address table for filtering specified addresses, displaying current entries, clearing the table, or setting the aging time.

Table 33-1. Address Table Commands

Command	Function	Mode
mac-address-table aging-time	Sets the aging time of the address table	GC
mac-address-table static	Maps a static address to a port in a VLAN	GC
clear mac-address-table dynamic	Removes any learned entries from the forwarding database	PE
show mac-address-table	Displays entries in the bridge-forwarding database	PE
show mac-address-table aging-time	Shows the aging time for the address table	PE
show mac-address-table count	Shows the number of MAC addresses used and the number of available MAC addresses	PE

mac-address-table aging-time

This command sets the aging time for entries in the address table. Use the **no** form to restore the default aging time.

Syntax

mac-address-table aging-time *seconds*

no mac-address-table aging-time

seconds - Aging time. (10-672 seconds; 0 to disable aging)

Default Setting

300 seconds

Command Mode

Global Configuration

Command Usage

The aging time is used to age out dynamically learned forwarding information.

Example

```
SSE-G2252(config)#mac-address-table aging-time 100
SSE-G2252(config)#
```

mac-address-table static

This command maps a static address to a destination port in a VLAN. Use the **no** form to remove an address.

Syntax

mac-address-table static *mac-address* **interface** *interface* **vlan** *vlan-id* [*action*]

no mac-address-table static *mac-address* **vlan** *vlan-id*

mac-address - MAC address.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

vlan-id - VLAN ID (Range: 1-4093)

action

delete-on-reset - Assignment lasts until the switch is reset.

permanent - Assignment is permanent.

Default Setting

No static addresses are defined. The default mode is **permanent**.

Command Mode

Global Configuration

Command Usage

The static address for a host device can be assigned to a specific port within a specific VLAN. Use this command to add static addresses to the MAC Address Table. Static addresses have the following characteristics:

- Static addresses will not be removed from the address table when a given interface link is down.
- Static addresses are bound to the assigned interface and will not be moved. When a static address is seen on another interface, the address will be ignored and will not be written to the address table.
- A static address cannot be learned on another port until the address is removed with the **no** form of this command.

Example

```
SSE-G2252(config)#mac-address-table static 00-e0-29-94-34-de interface
ethernet 1/1 vlan 1 delete-on-reset
SSE-G2252(config)#
```

clear mac-address-table dynamic

This command removes any learned entries from the forwarding database.

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#clear mac-address-table dynamic
SSE-G2252#
```

show mac-address-table

This command shows classes of entries in the bridge-forwarding database.

Syntax

show mac-address-table [**address** *mac-address* [*mask*]] [**interface** *interface*] [**vlan** *vlan-id*]
[**sort** {**address** | **vlan** | **interface**}]

mac-address - MAC address.

mask - Bits to match in the address.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

vlan-id - VLAN ID (Range: 1-4093)

sort - Sort by address, vlan or interface.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- The MAC Address Table contains the MAC addresses associated with each interface. Note that the Type field may include the following types:
  - Learn - Dynamic address entries
  - Config - Static entry
- The mask should be hexadecimal numbers (representing an equivalent bit mask) in the form xx-xx-xx-xx-xx-xx that is applied to the specified MAC address. Enter hexadecimal numbers, where an equivalent binary bit “0” means to match a bit and “1” means to ignore a bit. For example, a mask of 00-00-00-00-00-00 means an exact match, and a mask of FF-FF-FF-FF-FF-FF means “any.”
- The maximum number of address entries is 8K.

Example

```
SSE-G2252#show mac-address-table
 Interface MAC Address       VLAN Type     Life Time
 --------- ----------------- ---- -------- -----------------
  Eth 1/ 1 00-E0-29-94-34-DE    1 Config   Delete on Reset
  Eth 1/21 00-01-EC-F8-D8-D9    1 Learn    Delete on Timeout
SSE-G2252#
```

show mac-address-table aging-time

This command shows the aging time for entries in the address table.

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#show mac-address-table aging-time
 Aging Status : Enabled
 Aging Time: 300 sec.
SSE-G2252#
```

show mac-address-table count

This command shows the number of MAC addresses used and the number of available MAC addresses for the overall system or for an interface.

Syntax

show mac-address-table count interface *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#show mac-address-table count interface ethernet 1/1

MAC Entries for Port ID           : 1
Dynamic Address Count             : 2
Total MAC Addresses               : 2
Total MAC Address Space Available : 8192

SSE-G2252#
```

Chapter 34
Spanning Tree Commands

This section includes commands that configure the Spanning Tree Algorithm (STA) globally for the switch, and commands that configure STA for the selected interface.

Table 34-1. Spanning Tree Commands

Command	Function	Mode
spanning-tree	Enables the spanning tree protocol	GC
spanning-tree cisco-prestandard	Configures spanning tree operation to be compatible with Cisco prestandard versions	GC
spanning-tree forward-time	Configures the spanning tree bridge forward time	GC
spanning-tree hello-time	Configures the spanning tree bridge hello time	GC
spanning-tree max-age	Configures the spanning tree bridge maximum age	GC
spanning-tree mode	Configures STP, RSTP or MSTP mode	GC
spanning-tree pathcost method	Configures the path cost method for RSTP/MSTP	GC
spanning-tree priority	Configures the spanning tree bridge priority	GC
spanning-tree mst configuration	Changes to MSTP configuration mode	GC
spanning-tree transmission-limit	Configures the transmission limit for RSTP/MSTP	GC
max-hops	Configures the maximum number of hops allowed in the region before a BPDU is discarded	MST
mst priority	Configures the priority of a spanning tree instance	MST
mst vlan	Adds VLANs to a spanning tree instance	MST
name	Configures the name for the multiple spanning tree	MST
revision	Configures the revision number for the multiple spanning tree	MST
spanning-tree bpdu-filter	Filters BPDUs for edge ports	IC
spanning-tree bpdu-guard	Shuts down an edge port if it receives a BPDU	IC
spanning-tree cost	Configures the spanning tree path cost of an interface	IC
spanning-tree edge-port	Enables fast forwarding for edge ports	IC
spanning-tree link-type	Configures the link type for RSTP/MSTP	IC
spanning-tree loopback-detection	Enables BPDU loopback detection for a port	IC
spanning-tree loopback-detection release-mode	Configures loopback release mode for a port	IC
spanning-tree loopback-detection trap	Enables BPDU loopback SNMP trap notification for a port	IC
spanning-tree mst cost	Configures the path cost of an instance in the MST	IC
spanning-tree mst port-priority	Configures the priority of an instance in the MST	IC
spanning-tree port-priority	Configures the spanning tree priority of an interface	IC

Table 34-1. Spanning Tree Commands (Continued)

Command	Function	Mode
spanning-tree root-guard	Prevents a designated port from passing superior BPDUs	IC
spanning-tree spanning-disabled	Disables spanning tree for an interface	IC
spanning-tree loopback-detection release	Manually releases a port placed in discarding state by loopback-detection	PE
spanning-tree protocol-migration	Re-checks the appropriate BPDU format	PE
show spanning-tree	Shows spanning tree configuration for the common spanning tree (i.e., overall bridge), a selected interface, or an instance within the multiple spanning tree	PE
show spanning-tree mst configuration	Shows the multiple spanning tree configuration	PE

spanning-tree

This command enables the Spanning Tree Algorithm globally for the switch. Use the **no** form to disable it.

Syntax

[**no**] **spanning-tree**

Default Setting

Spanning tree is enabled.

Command Mode

Global Configuration

Command Usage

The Spanning Tree Algorithm (STA) can be used to detect and disable network loops, and to provide backup links between switches, bridges or routers. This allows the switch to interact with other bridging devices (that is, an STA-compliant switch, bridge or router) in your network to ensure that only one route exists between any two stations on the network, and provide backup links which automatically take over when a primary link goes down.

Example

This example shows how to enable the Spanning Tree Algorithm for the switch:

```
SSE-G2252(config)#spanning-tree
SSE-G2252(config)#
```

spanning-tree cisco-prestandard

This command configures spanning tree operation to be compatible with Cisco prestandard versions. Use the **no** form to restore the default setting.

[**no**] **spanning-tree cisco-prestandard**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

Cisco prestandard versions prior to Cisco IOS Release 12.2(25)SEC do not fully follow the IEEE standard, causing some state machine procedures to function incorrectly. The command forces the spanning tree protocol to function in a manner compatible with Cisco prestandard versions.

Example

```
SSE-G2252(config)#spanning-tree cisco-prestandard
SSE-G2252(config)#
```

spanning-tree forward-time

This command configures the spanning tree bridge forward time globally for this switch. Use the **no** form to restore the default.

Syntax

spanning-tree forward-time *seconds*

no spanning-tree forward-time

seconds - Time in seconds. (Range: 4 - 30 seconds)
The minimum value is the higher of 4 or [(max-age / 2) + 1].

Default Setting

15 seconds

Command Mode

Global Configuration

Command Usage

This command sets the maximum time (in seconds) the root device will wait before changing states (i.e., discarding to learning to forwarding). This delay is required because every device must receive information about topology changes before it starts to forward frames. In addition, each port needs time to listen for conflicting information that would make it return to the discarding state; otherwise, temporary data loops might result.

Example

```
SSE-G2252(config)#spanning-tree forward-time 20
SSE-G2252(config)#
```

spanning-tree hello-time

This command configures the spanning tree bridge hello time globally for this switch. Use the **no** form to restore the default.

Syntax

spanning-tree hello-time *time*

no spanning-tree hello-time

time - Time in seconds. (Range: 1-10 seconds).
The maximum value is the lower of 10 or [(max-age / 2) - 1].

Default Setting

2 seconds

Command Mode

Global Configuration

Command Usage

This command sets the time interval (in seconds) at which the root device transmits a configuration message.

Example

```
SSE-G2252(config)#spanning-tree hello-time 5
SSE-G2252(config)#
```

Related Commands

"spanning-tree forward-time" on page 34-3

"spanning-tree max-age" on page 34-5

spanning-tree max-age

This command configures the spanning tree bridge maximum age globally for this switch. Use the **no** form to restore the default.

Syntax

spanning-tree max-age *seconds*

no spanning-tree max-age

seconds - Time in seconds (Range: 6-40 seconds). The minimum value is the higher of 6 or [2 x (hello-time + 1)]. The maximum value is the lower of 40 or [2 x (forward-time - 1)].

Default Setting

20 seconds

Command Mode

Global Configuration

Command Usage

This command sets the maximum time (in seconds) a device can wait without receiving a configuration message before attempting to reconfigure. All device ports (except for designated ports) should receive configuration messages at regular intervals. Any port that ages out STA information (provided in the last configuration message) becomes the designated port for the attached LAN. If it is a root port, a new root port is selected from among the device ports attached to the network.

Example

```
SSE-G2252(config)#spanning-tree max-age 40
SSE-G2252(config)#
```

Related Commands

"spanning-tree forward-time" on page 34-3

"spanning-tree hello-time" on page 34-4

spanning-tree mode

This command selects the spanning tree mode for this switch. Use the **no** form to restore the default.

Syntax

spanning-tree mode {**stp** | **rstp** | **mstp**}

no spanning-tree mode

stp - Spanning Tree Protocol (IEEE 802.1D)

rstp - Rapid Spanning Tree Protocol (IEEE 802.1w)

mstp - Multiple Spanning Tree (IEEE 802.1s)

Default Setting

rstp

Command Mode

Global Configuration

Command Usage

- Spanning Tree Protocol
  Uses RSTP for the internal state machine, but sends only 802.1D BPDUs. This creates one spanning tree instance for the entire network. If multiple VLANs are implemented on a network, the path between specific VLAN members may be inadvertently disabled to prevent network loops, thus isolating group members. When operating multiple VLANs, we recommend selecting the MSTP option.
- Rapid Spanning Tree Protocol
  RSTP supports connections to either STP or RSTP nodes by monitoring the incoming protocol messages and dynamically adjusting the type of protocol messages the RSTP node transmits, as described below:
  - STP Mode – If the switch receives an 802.1D BPDU after a port's migration delay timer expires, the switch assumes it is connected to an 802.1D bridge and starts using only 802.1D BPDUs.
  - RSTP Mode – If RSTP is using 802.1D BPDUs on a port and receives an RSTP BPDU after the migration delay expires, RSTP restarts the migration delay timer and begins using RSTP BPDUs on that port.
- Multiple Spanning Tree Protocol
  - To allow multiple spanning trees to operate over the network, you must configure a related set of bridges with the same MSTP configuration, allowing them to participate in a specific set of spanning tree instances.
  - A spanning tree instance can exist only on bridges that have compatible VLAN instance assignments.

- Be careful when switching between spanning tree modes. Changing modes stops all spanning-tree instances for the previous mode and restarts the system in the new mode, temporarily disrupting user traffic.

Example

The following example configures the switch to use Rapid Spanning Tree:

```
SSE-G2252(config)#spanning-tree mode rstp
SSE-G2252(config)#
```

spanning-tree pathcost method

This command configures the path cost method used for Rapid Spanning Tree and Multiple Spanning Tree. Use the **no** form to restore the default.

Syntax

spanning-tree pathcost method {**long** | **short**}

no spanning-tree pathcost method

long - Specifies 32-bit based values that range from 1-200,000,000. This method is based on the IEEE 802.1w Rapid Spanning Tree Protocol.

short - Specifies 16-bit based values that range from 1-65535. This method is based on the IEEE 802.1 Spanning Tree Protocol.

Default Setting

Long method

Command Mode

Global Configuration

Command Usage

- The path cost method is used to determine the best path between devices. Therefore, lower values should be assigned to ports attached to faster media, and higher values assigned to ports with slower media. Note that path cost ("spanning-tree cost" on page 34-18) takes precedence over port priority ("spanning-tree port-priority" on page 34-26).
- The path cost methods apply to all spanning tree modes (STP, RSTP and MSTP). Specifically, the long method can be applied to STP since this mode is supported by a backward compatible mode of RSTP.

Example

```
SSE-G2252(config)#spanning-tree pathcost method long
SSE-G2252(config)#
```

spanning-tree priority

This command configures the spanning tree priority globally for this switch. Use the **no** form to restore the default.

Syntax

spanning-tree priority *priority*

no spanning-tree priority

priority - Priority of the bridge. (Range – 0-61440, in steps of 4096; Options: 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, 61440)

Default Setting

32768

Command Mode

Global Configuration

Command Usage

Bridge priority is used in selecting the root device, root port, and designated port. The device with the highest priority (i.e., lower numeric value) becomes the STA root device. However, if all devices have the same priority, the device with the lowest MAC address will then become the root device.

Example

```
SSE-G2252(config)#spanning-tree priority 40000
SSE-G2252(config)#
```

spanning-tree mst configuration

This command changes to Multiple Spanning Tree (MST) configuration mode.

Default Setting

No VLANs are mapped to any MST instance. The region name is set the switch's MAC address.

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#spanning-tree mst configuration
SSE-G2252(config-mstp)#
```

Related Commands

"mst vlan" on page 34-13

"mst priority" on page 34-12

"name" on page 34-14

"revision" on page 34-15

"max-hops" on page 34-11

spanning-tree transmission-limit

This command configures the minimum interval between the transmission of consecutive RSTP/MSTP BPDUs. Use the **no** form to restore the default.

Syntax

spanning-tree transmission-limit *count*

no spanning-tree transmission-limit

count - The transmission limit in seconds. (Range: 1-10)

Default Setting

3

Command Mode

Global Configuration

Command Usage

This command limits the maximum transmission rate for BPDUs.

Example

```
SSE-G2252(config)#spanning-tree transmission-limit 4
SSE-G2252(config)#
```

max-hops

This command configures the maximum number of hops in the region before a BPDU is discarded. Use the **no** form to restore the default.

Syntax

max-hops *hop-number*

hop-number - Maximum hop number for multiple spanning tree. (Range: 1-40)

Default Setting

20

Command Mode

MST Configuration

Command Usage

An MSTI region is treated as a single node by the STP and RSTP protocols. Therefore, the message age for BPDUs inside an MSTI region is never changed. However, each spanning tree instance within a region, and the internal spanning tree (IST) that connects these instances use a hop count to specify the maximum number of bridges that will propagate a BPDU. Each bridge decrements the hop count by one before passing on the BPDU. When the hop count reaches zero, the message is dropped.

Example

```
SSE-G2252(config-mstp)#max-hops 30
SSE-G2252(config-mstp)#
```

mst priority

This command configures the priority of a spanning tree instance. Use the **no** form to restore the default.

Syntax

mst *instance-id* **priority** *priority*

no mst *instance-id* **priority**

instance-id - Instance identifier of the spanning tree.
(Range: 0-4094)

priority - Priority of the a spanning tree instance. (Range: 0-61440 in steps of 4096; Options: 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, 61440)

Default Setting

32768

Command Mode

MST Configuration

Command Usage

- MST priority is used in selecting the root bridge and alternate bridge of the specified instance. The device with the highest priority (i.e., lowest numerical value) becomes the MSTI root device. However, if all devices have the same priority, the device with the lowest MAC address will then become the root device.
- You can set this switch to act as the MSTI root device by specifying a priority of 0, or as the MSTI alternate device by specifying a priority of 16384.

Example

```
SSE-G2252(config-mstp)#mst 1 priority 4096
SSE-G2252(config-mstp)#
```

mst vlan

This command adds VLANs to a spanning tree instance. Use the **no** form to remove the specified VLANs. Using the **no** form without any VLAN parameters to remove all VLANs.

Syntax

[**no**] **mst** *instance-id* **vlan** *vlan-range*

instance-id - Instance identifier of the spanning tree. (Range: 0-4094)

vlan-range - Range of VLANs. (Range: 1-4093)

Default Setting

none

Command Mode

MST Configuration

Command Usage

- Use this command to group VLANs into spanning tree instances. MSTP generates a unique spanning tree for each instance. This provides multiple pathways across the network, thereby balancing the traffic load, preventing wide-scale disruption when a bridge node in a single instance fails, and allowing for faster convergence of a new topology for the failed instance.
- By default all VLANs are assigned to the Internal Spanning Tree (MSTI 0) that connects all bridges and LANs within the MST region. This switch supports up to 58 instances. You should try to group VLANs which cover the same general area of your network. However, remember that you must configure all bridges within the same MSTI Region ("name" on page 34-14) with the same set of instances, and the same instance (on each bridge) with the same set of VLANs. Also, note that RSTP treats each MSTI region as a single node, connecting all regions to the Common Spanning Tree.

Example

```
SSE-G2252(config-mstp)#mst 1 vlan 2-5
SSE-G2252(config-mstp)#
```

name

This command configures the name for the multiple spanning tree region in which this switch is located. Use the **no** form to clear the name.

Syntax

name *name*

name - Name of the spanning tree.

Default Setting

Switch's MAC address

Command Mode

MST Configuration

Command Usage

The MST region name and revision number ("revision" on page 34-15) are used to designate a unique MST region. A bridge (i.e., spanning-tree compliant device such as this switch) can only belong to one MST region. And all bridges in the same region must be configured with the same MST instances.

Example

```
SSE-G2252(config-mstp)#name R&D
SSE-G2252(config-mstp)#
```

Related Commands

"revision" on page 34-15

revision

This command configures the revision number for this multiple spanning tree configuration of this switch. Use the no form to restore the default.

Syntax

revision *number*

number - Revision number of the spanning tree. (Range: 0-65535)

Default Setting

0

Command Mode

MST Configuration

Command Usage

The MST region name ("name" on page 34-14) and revision number are used to designate a unique MST region. A bridge (i.e., spanning-tree compliant device such as this switch) can only belong to one MST region. And all bridges in the same region must be configured with the same MST instances.

Example

```
SSE-G2252(config-mstp)#revision 1
SSE-G2252(config-mstp)#
```

Related Commands

"name" on page 34-14

spanning-tree bpdu-filter

This command filters all BPDUs received on an edge port. Use the **no** form to disable this feature.

Syntax

[**no**] **spanning-tree bpdu-filter**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- This command filters all Bridge Protocol Data Units (BPDUs) received on an interface to save CPU processing time. This function is designed to work in conjunction with edge ports which should only connect end stations to the switch, and therefore do not need to process BPDUs. However, note that if a trunking port connected to another switch or bridging device is mistakenly configured as an edge port, and BPDU filtering is enabled on this port, this might cause a loop in the spanning tree.
- Before enabling BPDU Filter, the interface must first be configured as an edge port with the spanning-tree edge-port command.

Example

```
SSE-G2252(config)#interface Ethernet 1/5
SSE-G2252(config-if)#spanning-tree edge-port
SSE-G2252(config-if)#spanning-tree bpdu-filter
SSE-G2252(config-if)#
```

Related Commands

"spanning-tree edge-port" on page 34-19

spanning-tree bpdu-guard

This command shuts down an edge port (i.e., an interface set for fast forwarding) if it receives a BPDU. Use the **no** form to disable this feature.

Syntax

[no] spanning-tree bpdu-guard

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- An edge port should only be connected to end nodes which do not generate BPDUs. If a BPDU is received on an edge port, this indicates an invalid network configuration, or that the switch may be under attack by a hacker. If an interface is shut down by BPDU Guard, it must be manually re-enabled using the no spanning-tree spanning-disabled command.
- Before enabling BPDU Guard, the interface must be configured as an edge port with the spanning-tree edge-port command. Also note that if the edge port attribute is disabled on an interface, BPDU Guard will also be disabled on that interface.

Example

```
SSE-G2252(config)#interface Ethernet 1/5
SSE-G2252(config-if)#spanning-tree edge-port
SSE-G2252(config-if)#spanning-tree bpdu-guard
SSE-G2252(config-if)#
```

Related Commands

"spanning-tree edge-port" on page 34-19

"spanning-tree spanning-disabled" on page 34-28

spanning-tree cost

This command configures the spanning tree path cost for the specified interface. Use the **no** form to restore the default auto-configuration mode.

Syntax

spanning-tree cost *cost*

no spanning-tree cost

cost - The path cost for the port. (Range: 0 for auto-configuration, 1-65535 for short path cost method[1], 1-200,000,000 for long path cost method)

Table 34-2. Recommended STA Path Cost Range

Port Type	Short Path Cost (IEEE 802.1D-1998)	Long Path Cost (802.1D-2004)
Ethernet	50-600	200,000-20,000,000
Fast Ethernet	10-60	20,000-2,000,000
Gigabit Ethernet	3-10	2,000-200,000

Default Setting

By default, the system automatically detects the speed and duplex mode used on each port, and configures the path cost according to the values shown below. Path cost "0" is used to indicate auto-configuration mode. When the short path cost method is selected and the default path cost recommended by the IEEE 8021w standard exceeds 65,535, the default is set to 65,535.

Table 34-3. Default STA Path Costs

Port Type	Short Path Cost (IEEE 802.1D-1998)	Long Path Cost (802.1D-2004)
Ethernet	65,535	1,000,000
Fast Ethernet	65,535	100,000
Gigabit Ethernet	10,000	10,000

Command Mode

Interface Configuration (Ethernet, Port Channel)

1. Use the spanning-tree pathcost method command to set the path cost method.

Command Usage

- This command is used by the Spanning Tree Algorithm to determine the best path between devices. Therefore, lower values should be assigned to ports attached to faster media, and higher values assigned to ports with slower media.
- Path cost takes precedence over port priority.
- When the path cost method ("spanning-tree pathcost method" on page 34-7) is set to short, the maximum value for path cost is 65,535.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#spanning-tree cost 50
SSE-G2252(config-if)#
```

spanning-tree edge-port

This command specifies an interface as an edge port. Use the **no** form to restore the default.

Syntax

spanning-tree edge-port [**auto**]

no spanning-tree edge-port

auto - Automatically determines if an interface is an edge port.

Default Setting

Auto

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

You can enable this option if an interface is attached to a LAN segment that is at the end of a bridged LAN or to an end node. Since end nodes cannot cause forwarding loops, they can pass directly through to the spanning tree forwarding state. Specifying Edge Ports provides quicker convergence for devices such as workstations or servers, retains the current forwarding database to reduce the amount of frame flooding required to rebuild address tables during reconfiguration events, does not cause the spanning tree to initiate reconfiguration when the interface changes state, and also overcomes other STA-related time out problems. However, remember that Edge Port should only be enabled for ports connected to an end-node device.

Example

```
SSE-G2252(config)#interface ethernet 1/5
```

```
SSE-G2252(config-if)#spanning-tree edge-port
SSE-G2252(config-if)#
```

spanning-tree link-type

This command configures the link type for Rapid Spanning Tree and Multiple Spanning Tree. Use the **no** form to restore the default.

Syntax

spanning-tree link-type {**auto** | **point-to-point** | **shared**}

no spanning-tree link-type

auto - Automatically derived from the duplex mode setting.

point-to-point - Point-to-point link.

shared - Shared medium.

Default Setting

auto

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Specify a point-to-point link if the interface can only be connected to exactly one other bridge, or a shared link if it can be connected to two or more bridges.
- When automatic detection is selected, the switch derives the link type from the duplex mode. A full-duplex interface is considered a point-to-point link, while a half-duplex interface is assumed to be on a shared link.
- RSTP only works on point-to-point links between two bridges. If you designate a port as a shared link, RSTP is forbidden. Since MSTP is an extension of RSTP, this same restriction applies.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#spanning-tree link-type point-to-point
```

spanning-tree loopback-detection

This command enables the detection and response to Spanning Tree loopback BPDU packets on the port. Use the **no** form to disable this feature.

Syntax

[**no**] **spanning-tree loopback-detection**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- If Port Loopback Detection is not enabled and a port receives it's own BPDU, then the port will drop the loopback BPDU according to IEEE Standard 802.1W-2001 9.3.4 (Note 1).
- Port Loopback Detection will not be active if Spanning Tree is disabled on the switch.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#spanning-tree loopback-detection
```

spanning-tree loopback-detection release-mode

This command configures the release mode for a port that was placed in the discarding state because a loopback BPDU was received. Use the **no** form to restore the default.

Syntax

spanning-tree loopback-detection release-mode
{**auto** | **manual**}

no spanning-tree loopback-detection release-mode

auto - Allows a port to automatically be released from the discarding state when the loopback state ends.

manual - The port can only be released from the discarding state manually.

Default Setting

auto

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- If the port is configured for automatic loopback release, then the port will only be returned to the forwarding state if one of the following conditions is satisfied:
  - The port receives any other BPDU except for it's own, or;
  - The port's link status changes to link down and then link up again, or;
  - The port ceases to receive it's own BPDUs in a forward delay interval.
- If Port Loopback Detection is not enabled and a port receives it's own BPDU, then the port will drop the loopback BPDU according to IEEE Standard 802.1W-2001 9.3.4 (Note 1).
- Port Loopback Detection will not be active if Spanning Tree is disabled on the switch.
- When configured for manual release mode, then a link down / up event will not release the port from the discarding state. It can only be released using the spanning-tree loopback-detection release command.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#spanning-tree loopback-detection release-mode manual
```

spanning-tree loopback-detection trap

This command enables SNMP trap notification for Spanning Tree loopback BPDU detections. Use the **no** form to restore the default.

Syntax

[**no**] **spanning-tree loopback-detection trap**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Example

```
SSE-G2252(config)#interface Ethernet 1/5
SSE-G2252(config-if)#spanning-tree loopback-detection trap
```

spanning-tree mst cost

This command configures the path cost on a spanning instance in the Multiple Spanning Tree. Use the **no** form to restore the default auto-configuration mode.

Syntax

spanning-tree mst *instance-id* **cost** *cost*

no spanning-tree mst *instance-id* **cost**

instance-id - Instance identifier of the spanning tree.
(Range: 0-4094, no leading zeroes)

cost - Path cost for an interface. (Range: 0 for auto-configuration, 1-65535 for short path cost method[2], 1-200,000,000 for long path cost method). The recommended path cost range is listed in Table 34-2: "Recommended STA Path Cost Range" on page 34-18.

2. Use the spanning-tree pathcost method command to set the path cost method.

Default Setting

By default, the system automatically detects the speed and duplex mode used on each port, and configures the path cost according to the values shown below. Path cost "0" is used to indicate auto-configuration mode. When the short path cost method is selected and the default path cost recommended by the IEEE 8021w standard exceeds 65,535, the default is set to 65,535. The default path costs are listed in Table 34-3: "Default STA Path Costs" on page 34-18.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Each spanning-tree instance is associated with a unique set of VLAN IDs.
- This command is used by the multiple spanning-tree algorithm to determine the best path between devices. Therefore, lower values should be assigned to interfaces attached to faster media, and higher values assigned to interfaces with slower media.
- Use the **no spanning-tree mst cost** command to specify auto-configuration mode.
- Path cost takes precedence over interface priority.

Example

```
SSE-G2252(config)#interface Ethernet 1/5
SSE-G2252(config-if)#spanning-tree mst 1 cost 50
SSE-G2252(config-if)#
```

Related Commands

"spanning-tree mst port-priority" on page 34-25

spanning-tree mst port-priority

This command configures the interface priority on a spanning instance in the Multiple Spanning Tree. Use the **no** form to restore the default.

Syntax

spanning-tree mst *instance-id* **port-priority** *priority*

no spanning-tree mst *instance-id* **port-priority**

instance-id - Instance identifier of the spanning tree.
(Range: 0-4094, no leading zeroes)

priority - Priority for an interface. (Range: 0-240 in steps of 16)

Default Setting

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- This command defines the priority for the use of an interface in the multiple spanning-tree. If the path cost for all interfaces on a switch are the same, the interface with the highest priority (that is, lowest value) will be configured as an active link in the spanning tree.
- Where more than one interface is assigned the highest priority, the interface with lowest numeric identifier will be enabled.

Example

```
SSE-G2252(config)#interface Ethernet 1/5
SSE-G2252(config-if)#spanning-tree mst 1 port-priority 0
SSE-G2252(config-if)#
```

Related Commands

"spanning-tree mst cost" on page 34-23

spanning-tree port-priority

This command configures the priority for the specified interface. Use the **no** form to restore the default.

Syntax

spanning-tree port-priority *priority*

no spanning-tree port-priority

priority - The priority for a port. (Range: 0-240, in steps of 16)

Default Setting

128

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- This command defines the priority for the use of a port in the Spanning Tree Algorithm. If the path cost for all ports on a switch are the same, the port with the highest priority (that is, lowest value) will be configured as an active link in the spanning tree.
- Where more than one port is assigned the highest priority, the port with lowest numeric identifier will be enabled.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#spanning-tree port-priority 0
```

Related Commands

"spanning-tree cost" on page 34-18

spanning-tree root-guard

This command prevents a designated port[3] from taking superior BPDUs into account and allowing a new STP root port to be elected. Use the **no** form to disable this feature.

Syntax

[**no**] **spanning-tree root-guard**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- A bridge with a lower bridge identifier (or same identifier and lower MAC address) can take over as the root bridge at any time.
- When Root Guard is enabled, and the switch receives a superior BPDU on this port, it is set to the Discarding state until it stops receiving superior BPDUs for a fixed recovery period. While in the discarding state, no traffic is forwarded across the port.
- Root Guard can be used to ensure that the root bridge is not formed at a suboptimal location. Root Guard should be enabled on any designated port connected to low-speed bridges which could potentially overload a slower link by taking over as the root port and forming a new spanning tree topology. It could also be used to form a border around part of the network where the root bridge is allowed.
- When spanning tree is initialized globally on the switch or on an interface, the switch will wait for 20 seconds to ensure that the spanning tree has converged before enabling Root Guard.

Example

```
SSE-G2252(config)#interface Ethernet 1/5
SSE-G2252(config-if)#spanning-tree edge-port
SSE-G2252(config-if)#spanning-tree root-guard
SSE-G2252(config-if)#
```

3. See Port Role under Section 9-5: "Displaying Interface Settings for STA" on page 9-16.

spanning-tree spanning-disabled

This command disables the spanning tree algorithm for the specified interface. Use the **no** form to re-enable the spanning tree algorithm for the specified interface.

Syntax

[**no**] **spanning-tree spanning-disabled**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Example

This example disables the spanning tree algorithm for port 5.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#spanning-tree spanning-disabled
SSE-G2252(config-if)#
```

spanning-tree loopback-detection release

This command manually releases a port placed in discarding state by loopback-detection.

Syntax

spanning-tree loopback-detection release *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Command Usage

Use this command to release an interface from discarding state if loopback detection release mode is set to "manual" by the spanning-tree loopback-detection release-mode command and BPDU loopback occurs.

Example

```
Console#spanning-tree loopback-detection release ethernet 1/1
Console#
```

spanning-tree protocol-migration

This command re-checks the appropriate BPDU format to send on the selected interface.

Syntax

spanning-tree protocol-migration *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Command Usage

If at any time the switch detects STP BPDUs, including Configuration or Topology Change Notification BPDUs, it will automatically set the selected interface to forced STP-compatible mode. However, you can also use the **spanning-tree protocol-migration** command at any time to manually re-check the appropriate BPDU format to send on the selected interfaces (i.e., RSTP or STP-compatible).

Example

```
SSE-G2252#spanning-tree protocol-migration eth 1/5
SSE-G2252#
```

show spanning-tree

This command shows the configuration for the common spanning tree (CST), for all instances within the multiple spanning tree (MST), or for a specific instance within the multiple spanning tree (MST).

Syntax

show spanning-tree [*interface* | **mst** [*instance-id*]]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

instance-id - Instance identifier of the multiple spanning tree. (Range: 0-4094, no leading zeroes)

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- Use the **show spanning-tree** command with no parameters to display the spanning tree configuration for the switch for the Common Spanning Tree (CST) and for every interface in the tree.
- Use the **show spanning-tree** *interface* command to display the spanning tree configuration for an interface within the Common Spanning Tree (CST).
- Use the **show spanning-tree mst** command to display the spanning tree configuration for all instances within the Multiple Spanning Tree (MST), including global settings and settings for active interfaces.
- Use the **show spanning-tree mst** *instance-id* command to display the spanning tree configuration for an instance within the Multiple Spanning Tree (MST), including global settings and settings for all interfaces.
- For a description of the items displayed under "Spanning-tree information," see Section 9-3: "Configuring Global Settings for STA" on page 9-5. For a description of the items displayed for specific interfaces, see Section 9-5: "Displaying Interface Settings for STA" on page 9-16.

Example

```
SSE-G2252#show spanning-tree
Spanning Tree Information
---------------------------------------------------------------
 Spanning Tree Mode              : MSTP
 Spanning Tree Enabled/Disabled  : Enabled
 Instance                        : 0
 VLANs Configured                : 1-4093
 Priority                        : 32768
 Bridge Hello Time (sec.)        : 2
 Bridge Max. Age (sec.)          : 20
 Bridge Forward Delay (sec.)     : 15
 Root Hello Time (sec.)          : 2
 Root Max. Age (sec.)            : 20
 Root Forward Delay (sec.)       : 15
 Max. Hops                       : 20
 Remaining Hops                  : 20
 Designated Root                 : 32768.0.0001ECF8D8C6
 Current Root Port               : 21
 Current Root Cost               : 100000
 Number of Topology Changes      : 5
 Last Topology Change Time (sec.): 11409
 Transmission Limit              : 3
 Path Cost Method                : Long
 Cisco Prestandard               : Disabled
---------------------------------------------------------------
Eth  1/ 1 information
---------------------------------------------------------------
 Admin Status                    : Enabled
 Role                            : Disabled
 State                           : Discarding
 External Admin Path Cost        : 0
 Internal Admin Path Cost        : 0
 External Oper Path Cost         : 100000
 Internal Oper Path Cost         : 100000
 Priority                        : 128
 Designated Cost                 : 100000
 Designated Port                 : 128.1
 Designated Root                 : 32768.0.0001ECF8D8C6
 Designated Bridge               : 32768.0.123412341234
 Fast Forwarding                 : Disabled
 Forward Transitions             : 4
 Admin Edge Port                 : Disabled
 Oper Edge Port                  : Disabled
 Admin Link Type                 : Auto
 Oper Link Type                  : Point-to-point
 Spanning-Tree Status            : Enabled
 Loopback Detection Status       : Enabled
 Loopback Detection Release Mode : Auto
 Loopback Detection Trap         : Disabled
 Root Guard Status               : Disabled
 BPDU Guard Status               : Disabled
 BPDU Filter Status              : Disabled
 Tx BPDUs                        : 11320
 Rx BPDUs                        : 0

.
.
.
```

show spanning-tree mst configuration

This command shows the configuration of the multiple spanning tree.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show spanning-tree mst configuration
Mstp Configuration Information
--------------------------------------------------------------
 Configuration Name : R&D
 Revision Level     :0

 Instance VLANs
--------------------------------------------------------------
     0    1-4093
SSE-G2252#
```

Chapter 35
VLAN Commands

A VLAN is a group of ports that can be located anywhere in the network, but communicate as though they belong to the same physical segment. This section describes commands used to create VLAN groups, add port members, specify how VLAN tagging is used, and enable automatic VLAN registration for the selected interface.

Table 35-1. VLAN Commands

Command Group	Function
GVRP and Bridge Extension Commands	Configures GVRP settings that permit automatic VLAN learning; shows the configuration for bridge extension MIB
Editing VLAN Groups	Sets up VLAN groups, including name, VID and state
Configuring VLAN Interfaces	Configures VLAN interface parameters, including ingress and egress tagging mode, ingress filtering, PVID, and GVRP
Displaying VLAN Information	Displays VLAN groups, status, port members, and MAC addresses
Configuring IEEE 802.1Q Tunneling	Configures 802.1Q Tunneling (QinQ Tunneling)
Configuring Port-based Traffic Segmentation	Configures traffic segmentation for different client sessions based on specified downlink and uplink ports
Configuring Protocol-based VLANs	Configures protocol-based VLANs based on frame type and protocol
Configuring IP Subnet VLANs	Configures IP Subnet-based VLANs
Configuring MAC Based VLANs	Configures MAC-based VLANs
Configuring Voice VLANs	Configures VoIP traffic detection and enables a Voice VLAN

35-1 GVRP and Bridge Extension Commands

GARP VLAN Registration Protocol defines a way for switches to exchange VLAN information in order to automatically register VLAN members on interfaces across the network. This section describes how to enable GVRP for individual interfaces and globally for the switch, as well as how to display default configuration settings for the Bridge Extension MIB.

Table 35-2. GVRP and Bridge Extension Commands

Command	Function	Mode
bridge-ext gvrp	Enables GVRP globally for the switch	GC
garp timer	Sets the GARP timer for the selected function	IC
switchport forbidden vlan	Configures forbidden VLANs for an interface	IC
switchport gvrp	Enables GVRP for an interface	IC
show bridge-ext	Shows the global bridge extension configuration	PE
show garp timer	Shows the GARP timer for the selected function	NE, PE
show gvrp configuration	Displays GVRP configuration for the selected interface	NE, PE

bridge-ext gvrp

This command enables GVRP globally for the switch. Use the **no** form to disable it.

Syntax

[**no**] **bridge-ext gvrp**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

GVRP defines a way for switches to exchange VLAN information in order to register VLAN members on ports across the network. This function should be enabled to permit automatic VLAN registration, and to support VLANs which extend beyond the local switch.

Example

```
SSE-G2252(config)#bridge-ext gvrp
SSE-G2252(config)#
```

garp timer

This command sets the values for the join, leave and leaveall timers. Use the **no** form to restore the timers' default values.

Syntax

garp timer {**join** | **leave** | **leaveall**} *timer-value*

no garp timer {**join** | **leave** | **leaveall**}

{**join** | **leave** | **leaveall**} - Timer to set.

timer-value - Value of timer. Ranges: join: 20-1000 centiseconds; leave: 60-3000 centiseconds; leaveall: 500-18000 centiseconds

Default Setting

join: 20 centiseconds

leave: 60 centiseconds

leaveall: 1000 centiseconds

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Group Address Registration Protocol is used by GVRP and GMRP to register or deregister client attributes for client services within a bridged LAN. The default values for the GARP timers are independent of the media access method or data rate. These values should not be changed unless you are experiencing difficulties with GMRP or GVRP registration/deregistration.
- Timer values are applied to GVRP for all the ports on all VLANs.
- Timer values must meet the following restrictions:
  - leave >= (2 x join)
  - leaveall > leave

NOTE: Set GVRP timers on all Layer 2 devices connected in the same network to the same values. Otherwise, GVRP may not operate successfully.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#garp timer join 100
SSE-G2252(config-if)#
```

Related Commands

"show garp timer" on page 35-6

switchport forbidden vlan

This command configures forbidden VLANs. Use the **no** form to remove the list of forbidden VLANs.

Syntax

switchport forbidden vlan {**add** *vlan-list* | **remove** *vlan-list*}

no switchport forbidden vlan

add *vlan-list* - List of VLAN identifiers to add.

remove *vlan-list* - List of VLAN identifiers to remove.

vlan-list - Separate nonconsecutive VLAN identifiers with a comma and no spaces; use a hyphen to designate a range of IDs. Do not enter leading zeros. (Range: 1-4093).

Default Setting

No VLANs are included in the forbidden list.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- This command prevents a VLAN from being automatically added to the specified interface via GVRP.
- If a VLAN has been added to the set of allowed VLANs for an interface, then you cannot add it to the set of forbidden VLANs for that same interface.

Example

The following example shows how to prevent port 1 from being added to VLAN 3:

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport forbidden vlan add 3
SSE-G2252(config-if)#
```

switchport gvrp

This command enables GVRP for a port. Use the **no** form to disable it.

Syntax

[**no**] **switchport gvrp**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

GVRP cannot be enabled for ports set to Access mode using the switchport mode command.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport gvrp
SSE-G2252(config-if)#
```

show bridge-ext

This command shows the configuration for bridge extension commands.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

See Section 5-4: "Displaying Bridge Extension Capabilities" on page 5-4 for a description of the displayed items.

Example

```
SSE-G2252#show bridge-ext
 Maximum Supported VLAN Numbers        : 256
 Maximum Supported VLAN ID             : 4093
 Extended Multicast Filtering Services : No
 Static Entry Individual Port          : Yes
 VLAN Learning                         : IVL
 Configurable PVID Tagging             : Yes
 Local VLAN Capable                    : No
 Traffic Classes                       : Enabled
 Global GVRP Status                    : Disabled
 GMRP                                  : Disabled
SSE-G2252#
```

show garp timer

This command shows the GARP timers for the selected interface.

Syntax

show garp timer [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

Shows all GARP timers.

Command Mode

Normal Exec, Privileged Exec

Example

```
SSE-G2252#show garp timer ethernet 1/1
Eth 1/ 1 GARP timer status:
 Join Timer:     20 centiseconds
 Leave Timer:    60 centiseconds
 Leaveall Timer: 1000 centiseconds
SSE-G2252#
```

Related Commands

"garp timer" on page 35-3

show gvrp configuration

This command shows if GVRP is enabled.

Syntax

show gvrp configuration [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

Shows both global and interface-specific configuration.

Command Mode

Normal Exec, Privileged Exec

Example

```
SSE-G2252#show gvrp configuration ethernet 1/7
Eth 1/ 7:
 GVRP Configuration : Disabled
SSE-G2252#
```

35-2 Editing VLAN Groups

Table 35-3. Commands for Editing VLAN Groups

Command	Function	Mode
vlan database	Enters VLAN database mode to add, change, and delete VLANs	GC
vlan	Configures a VLAN, including VID, name and state	VC

vlan database

This command enters VLAN database mode. All commands in this mode will take effect immediately.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Use the VLAN database command mode to add, change, and delete VLANs. After finishing configuration changes, you can display the VLAN settings by entering the show vlan command.
- Use the interface vlan command mode to define the port membership mode and add or remove ports from a VLAN. The results of these commands are written to the running-configuration file, and you can display this file by entering the show running-config command.

Example

```
SSE-G2252(config)#vlan database
SSE-G2252(config-vlan)#
```

Related Commands

"show vlan" on page 35-18

vlan

This command configures a VLAN. Use the **no** form to restore the default settings or delete a VLAN.

Syntax

vlan *vlan-id* [**name** *vlan-name*] **media ethernet**
[**state** {**active** | **suspend**}] [**rspan**]

no vlan *vlan-id* [**name** | **state**]

vlan-id - VLAN ID, specified as a single number, a range of consecutive numbers separated by a hyphen, or multiple numbers separated by commas. (Range: 1-4093, no leading zeroes)

name - Keyword to be followed by the VLAN name.

vlan-name - ASCII string from 1 to 32 characters.

media ethernet - Ethernet media type.

state - Keyword to be followed by the VLAN state.

active - VLAN is operational.

suspend - VLAN is suspended. Suspended VLANs do not pass packets.

rspan - Keyword to create a VLAN used for mirroring traffic from remote switches. The VLAN used for RSPAN cannot include VLAN 1 (the switch's default VLAN). Nor should it include VLAN 4093 (which is used for switch clustering). Configuring VLAN 4093 for other purposes may cause problems in the Clustering operation. For more information on configuring RSPAN through the CLI, see Section 30-2: "RSPAN Mirroring Commands" on page 30-5.

Default Setting

By default only VLAN 1 exists and is active.

Command Mode

VLAN Database Configuration

Command Usage

- **no vlan** *vlan-id* deletes the VLAN.
- **no vlan** *vlan-id* **name** removes the VLAN name.
- **no vlan** *vlan-id* **state** returns the VLAN to the default state (i.e., active).
- You can configure up to 4093 VLANs on the switch.

NOTE: The switch allows 256 user-manageable VLANs.

Example

The following example adds a VLAN, using VLAN ID 105 and name RD5. The VLAN is activated by default.

```
SSE-G2252(config)#vlan database
SSE-G2252(config-vlan)#vlan 105 name RD5 media ethernet
SSE-G2252(config-vlan)#
```

Related Commands

"show vlan" on page 35-18

35-3 Configuring VLAN Interfaces

Table 35-4. Commands for Configuring VLAN Interfaces

Command	Function	Mode
interface vlan	Enters interface configuration mode for a specified VLAN	IC
switchport acceptable-frame-types	Configures frame types to be accepted by an interface	IC
switchport allowed vlan	Configures the VLANs associated with an interface	IC
switchport forbidden vlan	Configures forbidden VLANs for an interface	IC
switchport gvrp	Enables GVRP for an interface	IC
switchport ingress-filtering	Enables ingress filtering on an interface	IC
switchport mode	Configures VLAN membership mode for an interface	IC
switchport native vlan	Configures the PVID (native VLAN) of an interface	IC
switchport priority default	Sets a port priority for incoming untagged frames	IC
vlan-trunking	Allows unknown VLANs to cross the switch	IC

interface vlan

This command enters interface configuration mode for VLANs, which is used to configure VLAN parameters for a physical interface.

Syntax

[**no**] **interface vlan** *vlan-id*

vlan-id - ID of the configured VLAN. (Range: 1-4093, no leading zeroes)

Default Setting

None

Command Mode

Global Configuration

Example

The following example shows how to set the interface configuration mode to VLAN 1, and then assign an IP address to the VLAN:

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ip address 192.168.1.254 255.255.255.0
SSE-G2252(config-if)#
```

Related Commands

"shutdown" on page 27-10

"interface" on page 27-2

"vlan" on page 35-9

switchport acceptable-frame-types

This command configures the acceptable frame types for a port. Use the **no** form to restore the default.

Syntax

switchport acceptable-frame-types {**all** | **tagged**}

no switchport acceptable-frame-types

all - The port accepts all frames, tagged or untagged.

tagged - The port only receives tagged frames.

Default Setting

All frame types

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

When set to receive all frame types, any received frames that are untagged are assigned to the default VLAN.

Example

The following example shows how to restrict the traffic received on port 1 to tagged frames:

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport acceptable-frame-types tagged
SSE-G2252(config-if)#
```

Related Commands

"switchport mode" on page 35-14

switchport allowed vlan

This command configures VLAN groups on the selected interface. Use the **no** form to restore the default.

Syntax

switchport allowed vlan {**add** *vlan-list* [**tagged** | **untagged**] | **remove** *vlan-list*}

no switchport allowed vlan

add *vlan-list* - List of VLAN identifiers to add.

remove *vlan-list* - List of VLAN identifiers to remove.

vlan-list - Separate nonconsecutive VLAN identifiers with a comma and no spaces; use a hyphen to designate a range of IDs. Do not enter leading zeros. (Range: 1-4093).

Default Setting

All ports are assigned to VLAN 1 by default.
The default frame type is untagged.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- A port, or a trunk with switchport mode set to **hybrid**, must be assigned to at least one VLAN as untagged.
- If a trunk has switchport mode set to **trunk** (i.e., 1Q Trunk), then you can only assign an interface to VLAN groups as a tagged member.
- Frames are always tagged within the switch. The tagged/untagged parameter used when adding a VLAN to an interface tells the switch whether to keep or remove the tag from a frame on egress.
- If none of the intermediate network devices nor the host at the other end of the connection supports VLANs, the interface should be added to these VLANs as an untagged member. Otherwise, it is only necessary to add at most one VLAN as untagged, and this should correspond to the native VLAN for the interface.
- If a VLAN on the forbidden list for an interface is manually added to that interface, the VLAN is automatically removed from the forbidden list for that interface.

Example

The following example shows how to add VLANs 1, 2, 5 and 6 to the allowed list as tagged VLANs for port 1:

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport allowed vlan add 1,2,5,6 tagged
SSE-G2252(config-if)#
```

switchport ingress-filtering

This command enables ingress filtering for an interface. Use the **no** form to restore the default.

Syntax

[**no**] **switchport ingress-filtering**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Ingress filtering only affects tagged frames.
- If ingress filtering is disabled and a port receives frames tagged for VLANs for which it is not a member, these frames will be flooded to all other ports (except for those VLANs explicitly forbidden on this port).
- If ingress filtering is enabled and a port receives frames tagged for VLANs for which it is not a member, these frames will be discarded.
- Ingress filtering does not affect VLAN independent BPDU frames, such as GVRP or STA. However, they do affect VLAN dependent BPDU frames, such as GMRP.

Example

The following example shows how to set the interface to port 1 and then enable ingress filtering:

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport ingress-filtering
SSE-G2252(config-if)#
```

switchport mode

This command configures the VLAN membership mode for a port. Use the **no** form to restore the default.

Syntax

switchport mode {**access** | **hybrid** | **trunk**}

no switchport mode

access - Specifies an access VLAN interface. The port transmits and receives untagged frames on a single VLAN only.

hybrid - Specifies a hybrid VLAN interface. The port may transmit tagged or untagged frames.

trunk - Specifies a port as an end-point for a VLAN trunk. A trunk is a direct link between two switches, so the port transmits tagged frames that identify the source VLAN. Note that frames belonging to the port's default VLAN (i.e., associated with the PVID) are also transmitted as tagged frames.

Default Setting

All ports are in access mode with the PVID set to VLAN 1.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

Access mode is mutually exclusive with VLAN trunking (see the vlan-trunking command). If VLAN trunking is enabled on an interface, then that interface cannot be set to access mode, and vice versa.

Example

The following shows how to set the configuration mode to port 1, and then set the switchport mode to hybrid:

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport mode hybrid
SSE-G2252(config-if)#
```

Related Commands

"switchport acceptable-frame-types" on page 35-12

switchport native vlan

This command configures the PVID (i.e., default VLAN ID) for a port. Use the **no** form to restore the default.

Syntax

switchport native vlan *vlan-id*

no switchport native vlan

vlan-id - Default VLAN ID for a port. (Range: 1-4093, no leading zeroes)

Default Setting

VLAN 1

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- When using Access mode, and an interface is assigned to a new VLAN, its PVID is automatically set to the identifier for that VLAN. When using Hybrid mode, the PVID for an interface can be set to any VLAN for which it is an untagged member.
- If acceptable frame types is set to **all** or switchport mode is set to **hybrid**, the PVID will be inserted into all untagged frames entering the ingress port.

Example

The following example shows how to set the PVID for port 1 to VLAN 3:

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport native vlan 3
SSE-G2252(config-if)#
```

vlan-trunking

This command allows unknown VLAN groups to pass through the specified interface. Use the **no** form to disable this feature.

Syntax

[**no**] **vlan-trunking**

Default Setting

Disabled

Command Mode

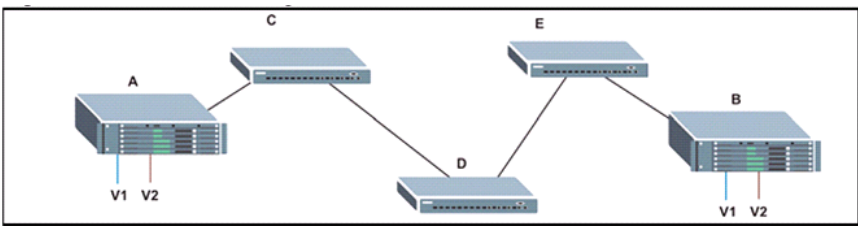
Interface Configuration (Ethernet, Port Channel)

Command Usage

- Use this command to configure a tunnel across one or more intermediate switches which pass traffic for VLAN groups to which they do not belong.

The following figure shows VLANs 1 and 2 configured on switches A and B, with VLAN trunking being used to pass traffic for these VLAN groups across switches C, D and E.

Figure 35-1. VLANs 1 and 2 Configured



Without VLAN trunking, you would have to configure VLANs 1 and 2 on all intermediate switches – C, D and E; otherwise these switches would drop any frames with unknown VLAN group tags. However, by enabling VLAN trunking on the intermediate switch ports along the path connecting VLANs 1 and 2, you only need to create these VLAN groups in switches A and B. Switches C, D and E automatically allow frames with VLAN group tags 1 and 2 (groups that are unknown to those switches) to pass through their VLAN trunking ports.

- VLAN trunking is mutually exclusive with the “access” switchport mode (see the switchport mode command). If VLAN trunking is enabled on an interface, then that interface cannot be set to access mode, and vice versa.
- To prevent loops from forming in the spanning tree, all unknown VLANs will be bound to a single instance (either STP/RSTP or an MSTP instance, depending on the selected STA mode).

- If both VLAN trunking and ingress filtering are disabled on an interface, packets with unknown VLAN tags will still be allowed to enter this interface and will be flooded to all other ports where VLAN trunking is enabled. (In other words, VLAN trunking will still be effectively enabled for the unknown VLAN).

Example

The following example enables VLAN trunking on ports 27 and 28 to establish a path across the switch for unknown VLAN groups:

```
SSE-G2252(config)#interface ethernet 1/27
SSE-G2252(config-if)#vlan-trunking
SSE-G2252(config-if)#interface ethernet 1/28
SSE-G2252(config-if)#vlan-trunking
SSE-G2252(config-if)#
```

35-4 Displaying VLAN Information

This section describes commands used to display VLAN information.

Table 35-5. Commands for Displaying VLAN Information

Command	Function	Mode
show interfaces status vlan	Displays status for the specified VLAN interface	NE, PE
show interfaces switchport	Displays the administrative and operational status of an interface	NE, PE
show vlan	Shows VLAN information	NE, PE

show vlan

This command shows VLAN information.

Syntax

show vlan [**id** *vlan-id* | **name** *vlan-name]*

id - Keyword to be followed by the VLAN ID.

vlan-id - ID of the configured VLAN. (Range: 1-4093, no leading zeroes)

name - Keyword to be followed by the VLAN name.

vlan-name - ASCII string from 1 to 32 characters.

Default Setting

Shows all VLANs.

Command Mode

Normal Exec, Privileged Exec

Example

The following example shows how to display information for VLAN 1:

```
SSE-G2252#show vlan id 1

VLAN ID:                1
Type:                   Static
Name:                   DefaultVlan
Status:                 Active
Ports/Port Channels : Eth1/ 1(S) Eth1/ 2(S) Eth1/ 3(S) Eth1/ 4(S) Eth1/
5(S)
                     Eth1/ 6(S) Eth1/ 7(S) Eth1/ 8(S) Eth1/ 9(S) Eth1/10(S)
                     Eth1/11(S) Eth1/12(S) Eth1/13(S) Eth1/14(S) Eth1/15(S)
                     Eth1/16(S) Eth1/17(S) Eth1/18(S) Eth1/19(S) Eth1/20(S)
                     Eth1/21(S) Eth1/22(S) Eth1/23(S) Eth1/24(S) Eth1/25(S)
                     Eth1/26(S) Eth1/27(S) Eth1/28(S) Eth1/29(S) Eth1/30(S)
                     Eth1/31(S) Eth1/32(S) Eth1/33(S) Eth1/34(S) Eth1/35(S)
                     Eth1/36(S) Eth1/37(S) Eth1/38(S) Eth1/39(S) Eth1/40(S)
                     Eth1/41(S) Eth1/42(S) Eth1/43(S) Eth1/44(S) Eth1/45(S)
                     Eth1/46(S) Eth1/47(S) Eth1/48(S) Eth1/49(S) Eth1/50(S)
                       Eth1/51(S) Eth1/52(S)
SSE-G2252#
```

35-5 Configuring IEEE 802.1Q Tunneling

IEEE 802.1Q tunneling (QinQ tunneling) uses a single Service Provider VLAN (SPVLAN) for customers who have multiple VLANs. Customer VLAN IDs are preserved and traffic from different customers is segregated within the service provider's network even when they use the same customer-specific VLAN IDs. QinQ tunneling expands VLAN space by using a VLAN-in-VLAN hierarchy, preserving the customer's original tagged packets, and adding SPVLAN tags to each frame (also called double tagging).

This section describes commands used to configure QinQ tunneling.

Table 35-6. 802.1Q Tunneling Commands

Command	Function	Mode
dot1q-tunnel system-tunnel-control	Configures the switch to operate in normal mode or QinQ mode	GC
switchport dot1q-tunnel mode	Configures an interface as a QinQ tunnel port	IC
switchport dot1q-tunnel tpid	Sets the Tag Protocol Identifier (TPID) value of a tunnel port	IC
show dot1q-tunnel	Displays the configuration of QinQ tunnel ports	PE
show interfaces switchport	Displays port QinQ operational status	PE

General Configuration Guidelines for QinQ

1. Configure the switch to QinQ mode (dot1q-tunnel system-tunnel-control).
2. Create a SPVLAN (vlan).
3. Configure the QinQ tunnel access port to dot1Q-tunnel access mode (switchport dot1q-tunnel mode).
4. Set the Tag Protocol Identifier (TPID) value of the tunnel access port. This step is required if the attached client is using a nonstandard 2-byte ethertype to identify 802.1Q tagged frames. The standard ethertype value is 0x8100. (See switchport dot1q-tunnel tpid.)
5. Configure the QinQ tunnel access port to join the SPVLAN as an untagged member (switchport allowed vlan).
6. Configure the SPVLAN ID as the native VID on the QinQ tunnel access port (switchport native vlan).
7. Configure the QinQ tunnel uplink port to dot1Q-tunnel uplink mode (switchport dot1q-tunnel mode).
8. Configure the QinQ tunnel uplink port to join the SPVLAN as a tagged member (switchport allowed vlan).

Limitations for QinQ

- The native VLAN for the tunnel uplink ports and tunnel access ports cannot be the same. However, the same service VLANs can be set on both tunnel port types.
- IGMP Snooping should not be enabled on a tunnel access port.

- If the spanning tree protocol is enabled, be aware that a tunnel access or tunnel uplink port may be disabled if the spanning tree structure is automatically reconfigured to overcome a break in the tree. It is therefore advisable to disable spanning tree on these ports.

dot1q-tunnel system-tunnel-control

This command sets the switch to operate in QinQ mode. Use the **no** form to disable QinQ operating mode.

Syntax

[**no**] **dot1q-tunnel system-tunnel-control**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

QinQ tunnel mode must be enabled on the switch for QinQ interface settings to be functional.

Example

```
SSE-G2252(config)#dot1q-tunnel system-tunnel-control
SSE-G2252(config)#
```

Related Commands

"show dot1q-tunnel" on page 35-24

"show interfaces switchport" on page 27-16

switchport dot1q-tunnel mode

This command configures an interface as a QinQ tunnel port. Use the **no** form to disable QinQ on the interface.

Syntax

switchport dot1q-tunnel mode {**access** | **uplink**}

no switchport dot1q-tunnel mode

access – Sets the port as an 802.1Q tunnel access port.

uplink – Sets the port as an 802.1Q tunnel uplink port.

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- QinQ tunneling must be enabled on the switch using the dot1q-tunnel system-tunnel-control command before the **switchport dot1q-tunnel mode** interface command can take effect.
- When a tunnel uplink port receives a packet from a customer, the customer tag (regardless of whether there are one or more tag layers) is retained in the inner tag, and the service provider's tag added to the outer tag.
- When a tunnel uplink port receives a packet from the service provider, the outer service provider's tag is stripped off, and the packet passed on to the VLAN indicated by the inner tag. If no inner tag is found, the packet is passed onto the native VLAN defined for the uplink port.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport dot1q-tunnel mode access
SSE-G2252(config-if)#
```

Related Commands

"show dot1q-tunnel" on page 35-24

"show interfaces switchport" on page 27-16

switchport dot1q-tunnel tpid

This command sets the Tag Protocol Identifier (TPID) value of a tunnel port. Use the **no** form to restore the default setting.

Syntax

switchport dot1q-tunnel tpid *tpid*

no switchport dot1q-tunnel tpid

tpid – Sets the ethertype value for 802.1Q encapsulation. This identifier is used to select a nonstandard 2-byte ethertype to identify 802.1Q tagged frames. The standard ethertype value is 0x8100. (Range: 0800-FFFF hexadecimal)

Default Setting

0x8100

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Use the **switchport dot1q-tunnel tpid** command to set a custom 802.1Q ethertype value on the selected interface. This feature allows the switch to interoperate with third-party switches that do not use the standard 0x8100 ethertype to identify 802.1Q-tagged frames. For example, 0x1234 is set as the custom 802.1Q ethertype on a trunk port, incoming frames containing that ethertype are assigned to the VLAN contained in the tag following the ethertype field, as they would be with a standard 802.1Q trunk. Frames arriving on the port containing any other ethertype are looked upon as untagged frames, and assigned to the native VLAN of that port.
- All ports on the switch will be set to the same ethertype.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport dot1q-tunnel tpid 9100
SSE-G2252(config-if)#
```

Related Commands

"show interfaces switchport" on page 27-16

show dot1q-tunnel

This command displays information about QinQ tunnel ports.

Command Mode

Privileged Exec

Example

```
SSE-G2252(config)#dot1q-tunnel system-tunnel-control
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport dot1q-tunnel mode access
SSE-G2252(config-if)#interface ethernet 1/2
SSE-G2252(config-if)#switchport dot1q-tunnel mode uplink
SSE-G2252(config-if)#end
SSE-G2252#show dot1q-tunnel

Current double-tagged status of the system is Enabled
The dot1q-tunnel mode of the set interface 1/1 is Access mode, TPID is
0x8100.
The dot1q-tunnel mode of the set interface 1/2 is Uplink mode, TPID is
0x8100.
The dot1q-tunnel mode of the set interface 1/3 is Normal mode, TPID is
0x8100.
.
.
.
```

Related Commands

"switchport dot1q-tunnel mode" on page 35-22

35-6 Configuring Port-based Traffic Segmentation

If tighter security is required for passing traffic from different clients through downlink ports on the local network and over uplink ports to the service provider, port-based traffic segmentation can be used to isolate traffic for individual clients.

Table 35-7. Commands for Configuring Traffic Segmentation

Command	Function	Mode
traffic-segmentation	Enables and configures traffic segmentation	GC
show traffic-segmentation	Displays the configured traffic segments	PE

traffic-segmentation

This command enables traffic segmentation globally, or configures the uplink and down-link ports for a segmented group of ports. Use the **no** form to disable traffic segmentation globally.

Syntax

[**no**] **traffic-segmentation** [**uplink** *interface-list* **downlink** *interface-list*]

uplink – Specifies an uplink interface.

downlink – Specifies a downlink interface.

Default Setting

Disabled globally

No segmented port groups are defined.

Command Mode

Global Configuration

Command Usage

- Traffic segmentation provides port-based security and isolation between ports within the VLAN. Data traffic on the downlink ports can only be forwarded to, and from, the designated uplink port(s). Data cannot pass between downlink ports in the same segmented group, nor to ports which do not belong to the same group.
- Any port can be defined as an uplink port or downlink port, but cannot be configured to serve both roles.
- Traffic segmentation and normal VLANs can exist simultaneously within the same switch. Traffic may pass freely between uplink ports in segmented groups and ports in normal VLANs.
- Enter the **traffic-segmentation** command without any parameters to enable traffic segmentation. Then set the interface members for segmented groups.
- Enter **no traffic-segmentation** to disable traffic segmentation and clear the configuration settings for segmented groups.

Example

This example enables traffic segmentation, and then sets port 12 as the uplink and ports 5-8 as downlinks.

```
SSE-G2252(config)#traffic-segmentation
SSE-G2252(config)#traffic-segmentation uplink ethernet 1/12
downlink ethernet 1/5-8
SSE-G2252(config)#
```

show traffic-segmentation

This command displays the configured traffic segments.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show traffic-segmentation
Private VLAN status: Disabled
Up-link Port:
 Ethernet 1/12
Down-link Port:
 Ethernet 1/5
 Ethernet 1/6
 Ethernet 1/7
 Ethernet 1/8
SSE-G2252#
```

35-7 Configuring Protocol-based VLANs

The network devices required to support multiple protocols cannot be easily grouped into a common VLAN. This may require non-standard devices to pass traffic between different VLANs in order to encompass all the devices participating in a specific protocol. This kind of configuration deprives users of the basic benefits of VLANs, including security and easy accessibility.

To avoid these problems, you can configure this switch with protocol-based VLANs that divide the physical network into logical VLAN groups for each required protocol. When a frame is received at a port, its VLAN membership can then be determined based on the protocol type in use by the inbound packets.

Table 35-8. Protocol-based VLAN Commands

Command	Function	Mode
protocol-vlan protocol-group (Configuring Groups)	Create a protocol group, specifying the supported protocols	GC
protocol-vlan protocol-group (Configuring Interfaces)	Maps a protocol group to a VLAN	IC
show protocol-vlan protocol-group	Shows the configuration of protocol groups	PE
show interfaces protocol-vlan protocol-group	Shows the interfaces mapped to a protocol group and the corresponding VLAN	PE

Configuring protocol-based VLANs

1. First configure VLAN groups for the protocols you want to use ("vlan" on page 35-9). Although not mandatory, we suggest configuring a separate VLAN for each major protocol running on your network. Do not add port members at this time.
2. Create a protocol group for each of the protocols you want to assign to a VLAN using the protocol-vlan protocol-group (Configuring Groups) command (Global Configuration mode).
3. Then map the protocol for each interface to the appropriate VLAN using the protocol-vlan protocol-group (Configuring Interfaces) command (Interface Configuration mode).

protocol-vlan protocol-group (Configuring Groups)

This command creates a protocol group, or to add specific protocols to a group. Use the **no** form to remove a protocol group.

Syntax

protocol-vlan protocol-group *group-id* [{**add** | **remove**} **frame-type** *frame* **protocol-type** *protocol*]

no protocol-vlan protocol-group *group-id*

group-id - Group identifier of this protocol group. (Range: 1-2147483647)

frame[1] - Frame type used by this protocol. (Options: ethernet, rfc_1042, llc_other)

protocol - Protocol type. The only option for the llc_other frame type is ipx_raw. The options for all other frames types include: arp, ip, ipv6, rarp.

Default Setting

No protocol groups are configured.

Command Mode

Global Configuration

Example

The following creates protocol group 1, and specifies Ethernet frames with IP and ARP protocol types:

```
SSE-G2252(config)#protocol-vlan protocol-group 1 add frame-type ethernet
protocol-type ip
SSE-G2252(config)#protocol-vlan protocol-group 1 add frame-type ethernet
protocol-type arp
SSE-G2252(config)#
```

1. SNAP frame types are not supported by this switch due to hardware limitations.

protocol-vlan protocol-group (Configuring Interfaces)

This command maps a protocol group to a VLAN for the current interface. Use the no form to remove the protocol mapping for this interface.

Syntax

protocol-vlan protocol-group *group-id* **vlan** *vlan-id*

no protocol-vlan protocol-group *group-id* **vlan**

group-id - Group identifier of this protocol group. (Range: 1-2147483647)

vlan-id - VLAN to which matching protocol traffic is forwarded. (Range: 1-4093)

Default Setting

No protocol groups are mapped for any interface.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- When creating a protocol-based VLAN, only assign interfaces via this command. If you assign interfaces using any of the other VLAN commands (such as the **vlan** command), these interfaces will admit traffic of any protocol type into the associated VLAN.
- When a frame enters a port that has been assigned to a protocol VLAN, it is processed in the following manner:
  - If the frame is tagged, it will be processed according to the standard rules applied to tagged frames.
  - If the frame is untagged and the protocol type matches, the frame is forwarded to the appropriate VLAN.
  - If the frame is untagged but the protocol type does not match, the frame is forwarded to the default VLAN for this interface.

Example

The following example maps the traffic entering Port 1 which matches the protocol type specified in protocol group 1 to VLAN 2.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#protocol-vlan protocol-group 1 vlan 2
SSE-G2252(config-if)#
```

show protocol-vlan protocol-group

This command shows the frame and protocol type associated with protocol groups.

Syntax

show protocol-vlan protocol-group [*group-id*]

group-id - Group identifier for a protocol group. (Range: 1-2147483647)

Default Setting

All protocol groups are displayed.

Command Mode

Privileged Exec

Example

This shows protocol group 1 configured for IP over Ethernet:

```
SSE-G2252#show protocol-vlan protocol-group

 Protocol Group ID   Frame Type    Protocol Type
------------------ ------------- ---------------
                 1      ethernet     08 00
SSE-G2252#
```

show interfaces protocol-vlan protocol-group

This command shows the mapping from protocol groups to VLANs for the selected interfaces.

Syntax

show interfaces protocol-vlan protocol-group [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

The mapping for all interfaces is displayed.

Command Mode

Privileged Exec

Example

This shows that traffic entering Port 1 that matches the specifications for protocol group 1 will be mapped to VLAN 2:

```
SSE-G2252#show interfaces protocol-vlan protocol-group

   Port     ProtocolGroup ID    VLAN ID
---------- ------------------ -----------
   Eth 1/1                  1       vlan2
SSE-G2252#
```

35-8 Configuring IP Subnet VLANs

When using IEEE 802.1Q port-based VLAN classification, all untagged frames received by a port are classified as belonging to the VLAN whose VID (PVID) is associated with that port.

When IP subnet-based VLAN classification is enabled, the source address of untagged ingress frames are checked against the IP subnet-to-VLAN mapping table. If an entry is found for that subnet, these frames are assigned to the VLAN indicated in the entry. If no IP subnet is matched, the untagged frames are classified as belonging to the receiving port's VLAN ID (PVID).

Table 35-9. IP Subnet VLAN Commands

Command	Function	Mode
subnet-vlan	Defines the IP Subnet VLANs	GC
show subnet-vlan	Displays IP Subnet VLAN settings	PE

subnet-vlan

This command configures IP Subnet VLAN assignments. Use the **no** form to remove an IP subnet-to-VLAN assignment.

Syntax

subnet-vlan subnet *ip-address mask* **vlan** *vlan-id* [**priority** *priority*]

no subnet-vlan subnet {*ip-address mask* | **all**}

ip-address – The IP address that defines the subnet. Valid IP addresses consist of four decimal numbers, 0 to 255, separated by periods.

mask – This mask identifies the host address bits of the IP subnet.

vlan-id – VLAN to which matching IP subnet traffic is forwarded. (Range: 1-4093)

priority – The priority assigned to untagged ingress traffic. (Range: 0-7, where 7 is the highest priority)

Default Setting

Priority: 0

Command Mode

Global Configuration

Command Usage

- Each IP subnet can be mapped to only one VLAN ID. An IP subnet consists of an IP address and a subnet mask.
- When an untagged frame is received by a port, the source IP address is checked against the IP subnet-to-VLAN mapping table, and if an entry is found, the corresponding VLAN ID is assigned to the frame. If no mapping is found, the PVID of the receiving port is assigned to the frame.
- The IP subnet cannot be a broadcast or multicast IP address.
- When MAC-based, IP subnet-based, and protocol-based VLANs are supported concurrently, priority is applied in this sequence, and then port-based VLANs last.

Example

The following example assigns traffic for the subnet 192.168.12.192, mask 255.255.255.224, to VLAN 4.

```
SSE-G2252(config)#subnet-vlan subnet 192.168.12.192 255.255.255.224 vlan 4
SSE-G2252(config)#
```

show subnet-vlan

This command displays IP Subnet VLAN assignments.

Command Mode

Privileged Exec

Command Usage

- Use this command to display subnet-to-VLAN mappings.
- The last matched entry is used if more than one entry can be matched.

Example

The following example displays all configured IP subnet-based VLANs.

```
SSE-G2252#show subnet-vlan
IP Address       Mask             VLAN ID  Priority
---------------  ---------------  -------  --------
192.168.12.0     255.255.255.128        1         0
192.168.12.128   255.255.255.192        3         0
192.168.12.192   255.255.255.224        4         0
192.168.12.224   255.255.255.240        5         0
192.168.12.240   255.255.255.248        6         0
192.168.12.248   255.255.255.252        7         0
192.168.12.252   255.255.255.254        8         0
192.168.12.254   255.255.255.255        9         0
192.168.12.255   255.255.255.255       10         0
SSE-G2252#
```

35-9 Configuring MAC Based VLANs

When using IEEE 802.1Q port-based VLAN classification, all untagged frames received by a port are classified as belonging to the VLAN whose VID (PVID) is associated with that port.

When MAC-based VLAN classification is enabled, the source address of untagged ingress frames are checked against the MAC address-to-VLAN mapping table. If an entry is found for that address, these frames are assigned to the VLAN indicated in the entry. If no MAC address is matched, the untagged frames are classified as belonging to the receiving port's VLAN ID (PVID).

Table 35-10. MAC Based VLAN Commands

Command	Function	Mode
mac-vlan	Defines the IP Subnet VLANs	GC
show mac-vlan	Displays IP Subnet VLAN settings	PE

mac-vlan

This command configures MAC address-to-VLAN mapping. Use the **no** form to remove an assignment.

Syntax

mac-vlan mac-address *mac-address* **vlan** *vlan-id* [**priority** *priority*]

no mac-vlan mac-address {*mac-address* | **all**}

mac-address – The source MAC address to be matched. Configured MAC addresses can only be unicast addresses. The MAC address must be specified in the format xx-xx-xx-xx-xx-xx or xxxxxxxxxxxx.

vlan-id – VLAN to which the matching source MAC address traffic is forwarded. (Range: 1-4093)

priority – The priority assigned to untagged ingress traffic. (Range: 0-7, where 7 is the highest priority)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- The MAC-to-VLAN mapping applies to all ports on the switch.
- Source MAC addresses can be mapped to only one VLAN ID.
- Configured MAC addresses cannot be broadcast or multicast addresses.
- When MAC-based, IP subnet-based, and protocol-based VLANs are supported concurrently, priority is applied in this sequence, and then port-based VLANs last.

Example

The following example assigns traffic from source MAC address 00-00-00-11-22-33 to VLAN 10.

```
SSE-G2252(config)#mac-vlan mac-address 00-00-00-11-22-33 vlan 10
SSE-G2252(config)#
```

show mac-vlan

This command displays MAC address-to-VLAN assignments.

Command Mode

Privileged Exec

Command Usage

Use this command to display MAC address-to-VLAN mappings.

Example

The following example displays all configured MAC address-based VLANs.

```
SSE-G2252#show mac-vlan
MAC Address        VLAN ID   Priority
-----------------  --------  --------
00-00-00-11-22-33        10         0
SSE-G2252#
```

35-10Configuring Voice VLANs

The switch allows you to specify a Voice VLAN for the network and set a CoS priority for the VoIP traffic. VoIP traffic can be detected on switch ports by using the source MAC address of packets, or by using LLDP (IEEE 802.1AB) to discover connected VoIP devices. When VoIP traffic is detected on a configured port, the switch automatically assigns the port to the Voice VLAN. Alternatively, switch ports can be manually configured.

Table 35-11. Voice VLAN Commands

Command	Function	Mode
voice vlan	Defines the Voice VLAN ID	GC
voice vlan aging	Configures the aging time for Voice VLAN ports	GC
voice vlan mac-address	Configures VoIP device MAC addresses	GC
switchport voice vlan	Sets the Voice VLAN port mode	IC
switchport voice vlan priority	Sets the VoIP traffic priority for ports	IC
switchport voice vlan rule	Sets the automatic VoIP traffic detection method for ports	IC
switchport voice vlan security	Enables Voice VLAN security on ports	IC
show voice vlan	Displays Voice VLAN settings	PE

voice vlan

This command enables VoIP traffic detection and defines the Voice VLAN ID. Use the **no** form to disable the Voice VLAN.

Syntax

voice vlan *voice-vlan-id*

no voice vlan

voice-vlan-id - Specifies the voice VLAN ID. (Range: 1-4093)

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- When IP telephony is deployed in an enterprise network, it is recommended to isolate the Voice over IP (VoIP) network traffic from other data traffic. Traffic isolation helps prevent excessive packet delays, packet loss, and jitter, which results in higher voice quality. This is best achieved by assigning all VoIP traffic to a single VLAN.
- VoIP traffic can be detected on switch ports by using the source MAC address of packets, or by using LLDP (IEEE 802.1AB) to discover connected VoIP devices. When VoIP traffic is detected on a configured port, the switch automatically assigns the port as a tagged member of the Voice VLAN.
- Only one Voice VLAN is supported and it must already be created on the switch before it can be specified as the Voice VLAN.
- The Voice VLAN ID cannot be modified when the global auto-detection status is enabled (see the switchport voice vlan command.

Example

The following example enables VoIP traffic detection and specifies the Voice VLAN ID as 1234.

```
SSE-G2252(config)#voice vlan 1234
SSE-G2252(config)#
```

voice vlan aging

This command sets the Voice VLAN ID time out. Use the **no** form to restore the default.

Syntax

voice vlan aging *minutes*

no voice vlan

minutes - Specifies the port Voice VLAN membership time out. (Range: 5-43200 minutes)

Default Setting

1440 minutes

Command Mode

Global Configuration

Command Usage

The Voice VLAN aging time is the time after which a port is removed from the Voice VLAN when VoIP traffic is no longer received on the port.

The VoIP aging time starts to count down when the OUI's MAC address expires from the MAC address table. Therefore, the MAC address aging time should be added to the overall aging time. For example, if you configure the MAC adress table aging time to 30 seconds, and voice VLAN aging time to 5 minutes, then after 5.5 minutes, a port will be removed from the voice VLAN when VoIP traffic is no longer received on the port. Alternatively, if you clear the MAC address table manually, then the switch will also start counting down the voice VLAN aging time.

Example

The following example configures the Voice VLAN aging time as 3000 minutes.

```
SSE-G2252(config)#voice vlan aging 3000
SSE-G2252(config)#
```

voice vlan mac-address

This command specifies MAC address ranges to add to the OUI Telephony list. Use the **no** form to remove an entry from the list.

Syntax

voice vlan mac-address *mac-address* **mask** *mask-address* [**description** *description*]

no voice vlan mac-address *mac-address* **mask** *mask-address*

mac-address - Defines a MAC address OUI that identifies VoIP devices in the network. (For example, 01-23-45-00-00-00)

mask-address - Identifies a range of MAC addresses. (Range: 80-00-00-00-00-00 to FF-FF-FF-FF-FF-FF)

description - User-defined text that identifies the VoIP devices. (Range: 1-32 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- VoIP devices attached to the switch can be identified by the manufacturer's Organizational Unique Identifier (OUI) in the source MAC address of received packets. OUI numbers are assigned to manufacturers and form the first three octets of device MAC addresses. The MAC OUI numbers for VoIP equipment can be configured on the switch so that traffic from these devices is recognized as VoIP.
- Selecting a mask of FF-FF-FF-00-00-00 identifies all devices with the same OUI (the first three octets). Other masks restrict the MAC address range. Selecting FF-FF-FF-FF-FF-FF specifies a single MAC address.

Example

The following example adds a MAC OUI to the OUI Telephony list.

```
SSE-G2252(config)#voice vlan mac-address 00-12-34-56-78-90 mask
ff-ff-ff-00-00-00 description A new phone
SSE-G2252(config)#
```

switchport voice vlan

This command specifies the Voice VLAN mode for ports. Use the **no** form to disable the Voice VLAN feature on the port.

Syntax

switchport voice vlan {**manual** | **auto**}

no switchport voice vlan

manual - The Voice VLAN feature is enabled on the port, but the port must be manually added to the Voice VLAN.

auto - The port will be added as a tagged member to the Voice VLAN when VoIP traffic is detected on the port.

Default Setting

Disabled

Command Mode

Interface Configuration

Command Usage

- When auto is selected, you must select the method to use for detecting VoIP traffic, either OUI or 802.1ab (LLDP) using the switchport voice vlan rule command. When OUI is selected, be sure to configure the MAC address ranges in the Telephony OUI list using the voice vlan mac-address command.
- All ports are set to VLAN access mode by default. Prior to enabling VoIP for a port (by setting the VoIP mode to Auto or Manual as described below), first set the VLAN membership mode to hybrid using the switchport mode command.

Example

The following example sets port 1 to Voice VLAN auto mode.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport voice vlan auto
SSE-G2252(config-if)#
```

switchport voice vlan priority

This command specifies a CoS priority for VoIP traffic on a port. Use the **no** form to restore the default priority on a port.

Syntax

switchport voice vlan priority *priority-value*

no switchport voice vlan priority

priority-value - The CoS priority value. (Range: 0-6)

Default Setting

6

Command Mode

Interface Configuration

Command Usage

Specifies a CoS priority to apply to the port VoIP traffic on the Voice VLAN. The priority of any received VoIP packet is overwritten with the new priority when the Voice VLAN feature is active for the port.

Example

The following example sets the CoS priority to 5 on port 1.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport voice vlan priority 5
SSE-G2252(config-if)#
```

switchport voice vlan rule

This command selects a method for detecting VoIP traffic on a port. Use the **no** form to disable the detection method on the port.

Syntax

[**no**] **switchport voice vlan rule** {**oui** | **lldp**}

oui - Traffic from VoIP devices is detected by the Organizationally Unique Identifier (OUI) of the source MAC address.

lldp - Uses LLDP to discover VoIP devices attached to the port.

Default Setting

OUI: Enabled
LLDP: Disabled

Command Mode

Interface Configuration

Command Usage

- When OUI is selected, be sure to configure the MAC address ranges in the Telephony OUI list (see the voice vlan mac-address command. MAC address OUI numbers must be configured in the Telephony OUI list so that the switch recognizes the traffic as being from a VoIP device.
- LLDP checks that the “telephone bit” in the system capability TLV is turned on. See Chapter 39: "LLDP Commands" on page 39-1 for more information on LLDP.

Example

The following example enables the OUI method on port 1 for detecting VoIP traffic.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport voice vlan rule oui
SSE-G2252(config-if)#
```

switchport voice vlan security

This command enables security filtering for VoIP traffic on a port. Use the **no** form to disable filtering on a port.

Syntax

[**no**] **switchport voice vlan security**

Default Setting

Disabled

Command Mode

Interface Configuration

Command Usage

- Security filtering discards any non-VoIP packets received on the port that are tagged with the voice VLAN ID. VoIP traffic is identified by source MAC addresses configured in the Telephony OUI list, or through LLDP that discovers VoIP devices attached to the switch. Packets received from non-VoIP sources are dropped.
- When enabled, be sure the MAC address ranges for VoIP devices are configured in the Telephony OUI list (**voice vlan mac-address**).

Example

The following example enables security filtering on port 1.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#switchport voice vlan security
SSE-G2252(config-if)#
```

show voice vlan

This command displays the Voice VLAN settings on the switch and the OUI Telephony list.

Syntax

show voice vlan {**oui** | **status**}

oui - Displays the OUI Telephony list.

status - Displays the global and port Voice VLAN settings.

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#show voice vlan status
Global Voice VLAN Status
Voice VLAN Status     : Enabled
Voice VLAN ID         : 1234
Voice VLAN aging time : 1440 minutes

Voice VLAN Port Summary
Port     Mode     Security Rule      Priority Remaining Age
                                                (minutes)
-------- -------- -------- --------- -------- -------------
Eth 1/ 1 Auto     Enabled  OUI              6 100
Eth 1/ 2 Disabled Disabled OUI              6 NA
Eth 1/ 3 Manual   Enabled  OUI              5 100
Eth 1/ 4 Auto     Enabled  OUI              6 100
Eth 1/ 5 Disabled Disabled OUI              6 NA
Eth 1/ 6 Disabled Disabled OUI              6 NA
Eth 1/ 7 Disabled Disabled OUI              6 NA
Eth 1/ 8 Disabled Disabled OUI              6 NA
Eth 1/ 9 Disabled Disabled OUI              6 NA
Eth 1/10 Disabled Disabled OUI              6 NA

SSE-G2252#show voice vlan oui
OUI Address       Mask              Description
----------------- ----------------- ------------------------------
00-12-34-56-78-9A FF-FF-FF-00-00-00 old phones
00-11-22-33-44-55 FF-FF-FF-00-00-00 new phones
00-98-76-54-32-10 FF-FF-FF-FF-FF-FF Chris' phone

SSE-G2252#
```

Notes

Chapter 36
Class of Service Commands

The commands described in this section allow you to specify which data packets have greater precedence when traffic is buffered in the switch due to congestion. This switch supports CoS with eight priority queues for each port. Data packets in a port's high-priority queue will be transmitted before those in the lower-priority queues. The default priority can be set for each interface, also the queue service mode and the mapping of frame priority tags to the switch's priority queues can be configured.

Table 36-1. Priority Commands

Command Group	Function
Priority Commands (Layer 2)	Configures the queue mode, queue weights, and default priority for untagged frames
Priority Commands (Layer 3 and 4)	Sets the default priority processing method (CoS or DSCP), maps priority tags for internal processing, maps values from internal priority table to CoS values used in tagged egress packets for Layer 2 interfaces, maps internal per hop behavior to hardware queues

36-1 Priority Commands (Layer 2)

This section describes commands used to configure Layer 2 traffic priority on the switch.

Table 36-2. Priority Commands (Layer 2)

Command	Function	Mode
queue mode	Sets the queue mode to Shaped Deficit Weighted Round-Robin (SDWRR), strict priority, or a combination of strict and weighted queuing	GC
queue weight	Assigns round-robin weights to the priority queues	GC
switchport priority default	Sets a port priority for incoming untagged frames	IC
show interfaces switchport	Displays the administrative and operational status of an interface	PE
show queue mode	Shows the current queue mode	PE
show queue weight	Shows weights assigned to the weighted queues	PE

queue mode

This command sets the scheduling mode used for processing each of the class of service (CoS) priority queues. The options include strict priority, Weighted Round-Robin (WRR), or a combination of strict and weighted queuing. Use the **no** form to restore the default value.

Syntax

queue mode {**strict** | **wrr** | **strict-wrr** [*queue-type-list*]}

no queue mode

strict - Services the egress queues in sequential order, transmitting all traffic in the higher priority queues before servicing lower priority queues. This ensures that the highest priority packets are always serviced first, ahead of all other traffic.

wrr - Weighted Round-Robin shares bandwidth at the egress ports by using scheduling weights (based on the queue weight command), and servicing each queue in a round-robin fashion.

strict-wrr - Uses strict or weighted service as specified for each queue.

queue-type-list - Indicates if the queue is a normal or strict type.
(Options: 0 indicates a normal queue, 1 indicates a strict queue)

Default Setting

Strict and WRR, with Queue 3 using strict mode

Command Mode

Global Configuration

Command Usage

- The switch can be set to service the port queues based on strict priority, WRR, or a combination of strict and weighted queueing.
- Strict priority requires all traffic in a higher priority queue to be processed before lower priority queues are serviced.
- WRR queuing specifies a relative weight for each queue. WRR uses a predefined relative weight for each queue that determines the percentage of service time the switch services each queue before moving on to the next queue. This prevents the head-of-line blocking that can occur with strict priority queuing.
- If Strict and WRR mode is selected, a combination of strict and weighted service is used as specified for each queue. Regardless of the selected mode, the queues are processed sequentially from high to lower priority (i.e., queues 3 to 0). The queues assigned to use strict or WRR priority should be specified using the *queue-type-list* parameter.

- A weight can be assigned to each of the weighted queues (and thereby to the corresponding traffic priorities). This weight sets the frequency at which each queue is polled for service, and subsequently affects the response time for software applications assigned a specific priority value.
- Service time is shared at the egress ports by defining scheduling weights for WRR, or the queuing mode that uses a combination of strict and weighted queuing. Service time is allocated to each queue by calculating a precise number of bytes per second that will be serviced on each round.
- The specified queue mode applies to all interfaces.

Example

The following example sets the queue mode to strict priority service mode:

```
SSE-G2252(config)#queue mode strict
SSE-G2252(config)#
```

Related Commands

"queue weight" on page 36-4

"show queue mode" on page 36-6

queue weight

This command assigns weights to the four class of service (CoS) priority queues when using weighted queuing, or one of the queuing modes that use a combination of strict and weighted queuing. Use the **no** form to restore the default weights.

Syntax

queue weight *weight0...weight3*

no queue weight

weight0...weight3 - The ratio of weights for queues 0 - 3 determines the weights used by the SWDRR scheduler. (Range: 1-15)

Default Setting

Weights 1, 2, 4, 6 are assigned to queues 0 - 3 respectively.

Command Mode

Global Configuration

Command Usage

- This command shares bandwidth at the egress port by defining scheduling weights for SWDRR, or for the queuing mode that uses a combination of strict and weighted queuing ("queue mode" on page 36-2).
- Bandwidth is allocated to each queue by calculating a precise number of bytes per second that will be serviced on each round.

Example

The following example shows how to assign round-robin weights of 1 - 4 to the CoS priority queues 0 - 3.

```
SSE-G2252(config)#queue weight 1 2 3 4
SSE-G2252(config)#
```

Related Commands

"queue mode" on page 36-2

"show queue weight" on page 36-6

switchport priority default

This command sets a priority for incoming untagged frames. Use the **no** form to restore the default value.

Syntax

switchport priority default *default-priority-id*

no switchport priority default

default-priority-id - The priority number for untagged ingress traffic. The priority is a number from 0 to 7. Seven is the highest priority.

Default Setting

The priority is not set, and the default value for untagged frames received on the interface is zero.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- The precedence for priority mapping is IP DSCP, and then default switchport priority.
- The default priority applies for an untagged frame received on a port set to accept all frame types (i.e, receives both untagged and tagged frames). This priority does not apply to IEEE 802.1Q VLAN tagged frames. If the incoming frame is an IEEE 802.1Q VLAN tagged frame, the IEEE 802.1p User Priority bits will be used.
- The switch provides four priority queues for each port. It can be configured to use strict priority queuing, SDWRR, or a combination of strict and weighted queuing using the queue mode command. Inbound frames that do not have VLAN tags are tagged with the input port's default ingress user priority, and then placed in the appropriate priority queue at the output port. The default priority for all ingress ports is zero. Therefore, any inbound frames that do not have priority tags will be placed in queue 2 of the output port. (Note that if the output port is an untagged member of the associated VLAN, these frames are stripped of all VLAN tags prior to transmission.)

Example

The following example shows how to set a default priority on port 3 to 5:

```
SSE-G2252(config)#interface ethernet 1/3
SSE-G2252(config-if)#switchport priority default 5
SSE-G2252(config-if)#
```

Related Commands

"show interfaces switchport" on page 27-16

show queue mode

This command shows the current queue mode.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show queue mode

Queue Mode : Weighted Round Robin Mode
SSE-G2252#
```

show queue weight

This command displays the weights used for the weighted queues.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show queue weight
 Queue ID  Weight
 --------  ------
        0       1
        1       2
        2       4
        3       6
SSE-G2252#
```

36-2 Priority Commands (Layer 3 and 4)

This section describes commands used to configure Layer 3 and 4 traffic priority mapping on the switch.

Table 36-3. Priority Commands (Layer 3 and 4)[a]

Command	Function	Mode
qos map cos-dscp	Maps CoS/CFI values in incoming packets to per-hop behavior and drop precedence values for internal priority processing	IC
qos map dscp-mutation	Maps DSCP values in incoming packets to per-hop behavior and drop precedence values for internal priority processing	IC
qos map phb-queue	Maps internal per-hop behavior values to hardware queues	IC
qos map trust-mode	Sets QoS mapping to DSCP or CoS	IC
show qos map dscp-mutation	Shows ingress DSCP to internal DSCP map	PE
show qos map phb-queue	Shows internal per-hop behavior to hardware queue map	PE
show qos map cos-dscp	Shows ingress CoS to internal DSCP map	PE
show qos map trust-mode	Shows the QoS mapping mode	PE

a. The default settings used for mapping priority values to internal DSCP values and back to the hardware queues are designed to optimize priority services for the majority of network applications. It should not be necessary to modify any of the default settings unless a queuing problem occurs with a particular application.

qos map cos-dscp

This command maps CoS/CFI values in incoming packets to per-hop behavior and drop precedence values for priority processing. Use the **no** form to restore the default settings.

Syntax

qos map cos-dscp *phb drop-precedence* **from** *cos0 cfi0...cos7 cfi7*

no qos map cos-dscp *cos0 cfi0...cos7 cfi7*

phb - Per-hop behavior, or the priority used for this router hop. (Range: 0-7)

drop-precedence - Drop precedence used for Random Early Detection in controlling traffic congestion. (Range: 0 - Green, 3 - Yellow, 1 - Red)

cos - CoS value in ingress packets. (Range: 0-7)

cfi - Canonical Format Indicator. Set to this parameter to “0” to indicate that the MAC address information carried in the frame is in canonical format. (Range: 0-1)

Default Setting

Table 36-4. Default Mapping of CoS/CFI to Internal PHB/Drop Precedence

CFI CoS	0	1
0	(0,0)	(0,0)
1	(1,0)	(1,0)
2	(2,0)	(2,0)
3	(3,0)	(3,0)
4	(4,0)	(4,0)
5	(5,0)	(5,0)
6	(6,0)	(6,0)
7	(7,0)	(7,0)

Command Mode

Interface Configuration (Port, Static Aggregation)

Command Usage

- The default mapping of CoS to PHB values shown in Table 36-4 above is based upon the recommended settings in IEEE 802.1p for mapping CoS values to output queues.
- Enter a value pair for the internal per-hop behavior and drop precedence, followed by the keyword "from" and then up to eight CoS/CFI paired values separated by spaces.
- If a packet arrives with a 802.1Q header but it is not an IP packet, then the CoS/CFI-to-PHB/Drop Precedence mapping table is used to generate priority and drop precedence values for internal processing. Note that priority tags in the original packet are not modified by this command.
- The internal DSCP consists of three bits for per-hop behavior (PHB) which determines the queue to which a packet is sent; and two bits for drop precedence (namely color) which is used by Random Early Detection (RED) to control traffic congestion.
- RED starts dropping yellow and red packets when the buffer fills up to 16 packets on ports 1-48 and 72 packets on ports 49-50/52, and then starts dropping any packets regardless of color when the buffer fills up to 58 packets on ports 1-48 and 80 packets on ports 49-50/52.
- The specified mapping applies to all interfaces.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#qos map cos-dscp 0 0 from 0 1
```

```
SSE-G2252(config-if)#
```

qos map dscp-mutation

This command maps DSCP values in incoming packets to per-hop behavior and drop precedence values for priority processing. Use the **no** form to restore the default settings.

Syntax

qos map dscp-mutation *phb drop-precedence* **from** *dscp0 ... dscp7*

no qos map dscp-mutation *dscp0 ... dscp7*

phb - Per-hop behavior, or the priority used for this router hop. (Range: 0-7)

drop-precedence - Drop precedence used for Random Early Detection in controlling traffic congestion.
(Range: 0 - Green, 3 - Yellow, 1 - Red)

dscp - DSCP value in ingress packets. (Range: 0-63)

Default Setting

Table 36-5. Default Mapping of DSCP Values to Internal PHB/Drop Values

ingress-dscp1 ingress-dscp10[a]	0[b]	1	2	3	4	5	6	7	8	9
0	0,0	0,1	0,0	0,3	0,0	0,1	0,0	0,3	1,0	1,1
1	1,0	1,3	1,0	1,1	1,0	1,3	2,0	2,1	2,0	2,3
2	2,0	2,1	2,0	2,3	3,0	3,1	3,0	3,3	3.0	3,1
3	3,0	3,3	4,0	4,1	4,0	4,3	4,0	4,1	4.0	4,3
4	5,0	5,1	5,0	5,3	5,0	5,1	6,0	5,3	6,0	6,1
5	6,0	6,3	6,0	6,1	6,0	6,3	7,0	7,1	7.0	7,3
6	7,0	7,1	7,0	7,3						

a. The ingress DSCP is composed of ingress-dscp10 (most significant digit in the left column) and ingress-dscp1 (least significant digit in the top row (in other words, ingress-dscp = ingress-dscp10 * 10 + ingress-dscp1); and the corresponding internal-dscp is shown at the intersecting cell in the table.

b. The ingress DSCP is bitwise ANDed with the binary value 11 to determine the drop precedence. If the resulting value is 10 binary, then the drop precedence is set to 0.

Command Mode

Interface Configuration (Port, Static Aggregation)

Command Usage

- Enter a value pair for the internal per-hop behavior and drop precedence, followed by the keyword "from" and then up to eight DSCP values separated by spaces.
- This map is only used when the QoS mapping mode is set to "DSCP" by the qos map trust-mode command, and the ingress packet type is IPv4.
- Two QoS domains can have different DSCP definitions, so the DSCP-to-PHB/Drop Precedence mutation map can be used to modify one set of DSCP values to match the definition of another domain. The mutation map should be applied at the receiving port (ingress mutation) at the boundary of a QoS administrative domain.
- Random Early Detection starts dropping yellow and red packets when the buffer fills up to 0x60 packets, and then starts dropping any packets regardless of color when the buffer fills up to 0x80 packets.
- The specified mapping applies to all interfaces.

Example

This example changes the priority for all packets entering port 1 which contain a DSCP value of 1 to a per-hop behavior of 3 and a drop precedence of 1. Referring to Table 36-5: "Default Mapping of DSCP Values to Internal PHB/Drop Values" on page 36-9, note that the DSCP value for these packets is now set to 25 ($3x2^3+1$) and passed on to the egress interface.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#qos map dscp-mutation 3 1 from 1
SSE-G2252(config-if)#
```

qos map phb-queue

This command determines the hardware output queues to use based on the internal per-hop behavior value. Use the **no** form to restore the default settings.

Syntax

qos map phb-queue *queue-id* **from** *phb0 ... phb7*

no map phb-queue *phb0 ... phb7*

phb - Per-hop behavior, or the priority used for this router hop. (Range: 0-7)

queue-id - The ID of the priority queue. (Range: 0-7, where 7 is the highest priority queue)

Default Setting

Table 36-6. Mapping Internal Per-hop Behavior to Hardware Queues

Per-hop Behavior	0	1	2	3	4	5	6	7
Hardware Queues	1	0	0	1	2	2	3	3

Command Mode

Interface Configuration (Port, Static Aggregation)

Command Usage

- Enter a queue identifier, followed by the keyword “from” and then up to eight internal per-hop behavior values separated by spaces.
- Egress packets are placed into the hardware queues according to the mapping defined by this command.
- The specified mapping applies to all interfaces.

Example

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#qos map phb-queue 0 from 1 2 3
SSE-G2252(config-if)#
```

qos map trust-mode

This command sets QoS mapping to DSCP or CoS. Use the **no** form to restore the default setting.

Syntax

qos map trust-mode {**dscp** | **cos**}

no qos map trust-mode

dscp - Sets the QoS mapping mode to DSCP.

cos - Sets the QoS mapping mode to CoS.

Default Setting

DSCP

Command Mode

Interface Configuration (Port, Static Aggregation)

Command Usage

- If the QoS mapping mode is set to DSCP with this command, and the ingress packet type is IPv4, then priority processing will be based on the DSCP value in the ingress packet.
- If the QoS mapping mode is set to DSCP, and a non-IP packet is received, the packet's CoS and CFI (Canonical Format Indicator) values are used for priority processing if the packet is tagged. For an untagged packet, the default port priority (see "switchport priority default" on page 36-5) is used for priority processing.
- If the QoS mapping mode is set to CoS with this command, and the ingress packet type is IPv4, then priority processing will be based on the CoS and CFI values in the ingress packet.

For an untagged packet, the default port priority (see "switchport priority default" on page 36-5) is used for priority processing.

Example

This example sets the QoS priority mapping mode to use DSCP based on the conditions described in the Command Usage section.

```
SSE-G2252(config)#interface ge1/1
SSE-G2252(config-if)#qos map trust-mode cos
SSE-G2252(config-if)#
```

show qos map dscp-mutation

This command shows the ingress DSCP to internal DSCP map.

Syntax

show qos map dscp-mutation interface *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Command Usage

This map is only used when the QoS mapping mode is set to “DSCP” by the qos map trust-mode command, and the ingress packet type is IPv4.

Example

The ingress DSCP is composed of “d1” (most significant digit in the left column) and “d2” (least significant digit in the top row (in other words, ingress DSCP = d1 * 10 + d2); and the corresponding Internal DSCP and drop precedence is shown at the intersecting cell in the table.

```
SSE-G2252#show qos map dscp-mutation interface ethernet 1/5
dscp mutation map.(x,y),x: phb,y: drop precedence:
 d1: d2 0     1     2     3     4     5     6     7     8     9
 ------------------------------------------------------------------
 0 :    (0,0) (0,1) (0,0) (0,3) (0,0) (0,1) (0,0) (0,3) (1,0) (1,1)
 1 :    (1,0) (1,3) (1,0) (1,1) (1,0) (1,3) (2,0) (2,1) (2,0) (2,3)
 2 :    (2,0) (2,1) (2,0) (2,3) (3,0) (3,1) (3,0) (3,3) (3,0) (3,1)
 3 :    (3,0) (3,3) (4,0) (4,1) (4,0) (4,3) (4,0) (4,1) (4,0) (4,3)
 4 :    (5,0) (5,1) (5,0) (5,3) (5,0) (5,1) (6,0) (5,3) (6,0) (6,1)
 5 :    (6,0) (6,3) (6,0) (6,1) (6,0) (6,3) (7,0) (7,1) (7,0) (7,3)
 6 :    (7,0) (7,1) (7,0) (7,3)
SSE-G2252#
```

show qos map phb-queue

This command shows internal per-hop behavior to hardware queue map.

Syntax

show qos map phb-queue interface *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show qos map phb-queue interface ethernet 1/5
Information of Eth 1/5
 phb-queue map:
 phb:       0     1     2     3     4     5     6     7
 ----------------------------------------------------------
 queue:     2     0     1     3      4     5     6     7
SSE-G2252#
```

show qos map cos-dscp

This command shows ingress CoS/CFI to internal DSCP map.

Syntax

show qos map cos-dscp interface *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show qos map cos-dscp interface ethernet 1/5
 cos-dscp map.(x,y),x: phb,y: drop precedence:
 cos  : cfi  0          1
 --------------------------------
 0            (0,0)       (0,0)
 1            (1,0)       (1,0)
 2            (2,0)       (2,0)
 3            (3,0)       (3,0)
 4            (4,0)       (4,0)
 5            (5,0)       (5,0)
 6            (6,0)       (6,0)
 7            (7,0)       (7,0)
SSE-G2252#
```

show qos map trust-mode

This command shows the QoS mapping mode.

Syntax

show qos map trust-mode interface *interface*

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Example

The following shows that the trust mode is set to CoS:

```
SSE-G2252#show qos map trust-mode interface ethernet 1/5
Information of Eth 1/5
  COS Map mode:          cos mode
SSE-G2252#
```

Chapter 37
Quality of Service Commands

The commands described in this section are used to configure Differentiated Services (DiffServ) classification criteria and service policies. You can classify traffic based on access lists, IP Precedence or DSCP values, or VLANs. Using access lists allows you select traffic based on Layer 2, Layer 3, or Layer 4 information contained in each packet.

Table 37-1. Quality of Service Commands

Command	Function	Mode
class-map	Creates a class map for a type of traffic	GC
description	Specifies the description of a class map	CM
match	Defines the criteria used to classify traffic	CM
rename	Redefines the name of a class map	CM
policy-map	Creates a policy map for multiple interfaces	GC
description	Specifies the description of a policy map	PM
class	Defines a traffic classification for the policy to act on	PM
rename	Redefines the name of a policy map	PM
police flow	Defines an enforcer for classified traffic based on a metered flow rate	PM-C
police srtcm-color	Defines an enforcer for classified traffic based on a single rate three color meter	PM-C
police trtcm-color	Defines an enforcer for classified traffic based on a two rate three color meter	PM-C
set cos	Services IP traffic by setting a class of service value for matching packets for internal processing	PM-C
set ip dscp	Services IP traffic by setting an IP DSCP value for matching packets for internal processing	PM-C
set phb	Services IP traffic by setting a per-hop behavior value for matching packets for internal processing	PM-C
service-policy	Applies a policy map defined by the policy-map command to the input of a particular interface	IC
show class-map	Displays the QoS class maps which define matching criteria used for classifying traffic	PE
show policy-map	Displays the QoS policy maps which define classification criteria for incoming traffic, and may include policers for bandwidth limitations	PE
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface	PE

Creating a Service Policy for a Specific Category of Ingress Traffic

1. Use the class-map command to designate a class name for a specific category of traffic, and enter the Class Map configuration mode.
2. Use the match command to select a specific type of traffic based on an access list, a DSCP or IP Precedence value, or a VLAN.
3. Use the policy-map command to designate a policy name for a specific manner in which ingress traffic will be handled, and enter the Policy Map configuration mode.
4. Use the class command to identify the class map, and enter Policy Map Class configuration mode. A policy map can contain up to 16 class maps.
5. Use the set phb, set cos or set ip dscp command to modify the per-hop behavior or the class of service value in the VLAN tag for the matching traffic class, and use one of the **police** commands to monitor parameters such as the average flow and burst rate, and drop any traffic that exceeds the specified rate, or just reduce the DSCP service level for traffic exceeding the specified rate.
6. Use the service-policy command to assign a policy map to a specific interface.

NOTE: Create a Class Map before creating a Policy Map.

class-map

This command creates a class map used for matching packets to the specified class, and enters Class Map configuration mode. Use the **no** form to delete a class map.

Syntax

[**no**] **class-map** *class-map-name* [**match-any**]

class-map-name - Name of the class map. (Range: 1-32 characters)

match-any - Match any condition within a class map.

Default Setting

None

Command Mode

Global Configuration

Command Usage

- First enter this command to designate a class map and enter the Class Map configuration mode. Then use match commands to specify the criteria for ingress traffic that will be classified under this class map.

- One or more class maps can be assigned to a policy map ("policy-map" on page 37-6). The policy map is then bound by a service policy to an interface (page 37-17). A service policy defines packet classification, service tagging, and bandwidth policing. Once a policy map has been bound to an interface, no additional class maps may be added to the policy map, nor any changes made to the assigned class maps with the match or **set** commands.

Example

This example creates a class map call “rd-class,” and sets it to match packets marked for DSCP service value 3:

```
SSE-G2252(config)#class-map rd-class match-any
SSE-G2252(config-cmap)#match ip dscp 3
SSE-G2252(config-cmap)#
```

Related Commands

"show class-map" on page 37-18

description

This command specifies the description of a class map or policy map.

Syntax

description *string*

string - Description of the class map or policy map.
(Range: 1-64 characters)

Command Mode

Class Map Configuration

Policy Map Configuration

Example

```
SSE-G2252(config)#class-map rd-class#1
SSE-G2252(config-cmap)#description matches packets marked for DSCP service
value 3
SSE-G2252(config-cmap)#
```

match

This command defines the criteria used to classify traffic. Use the **no** form to delete the matching criteria.

Syntax

[**no**] **match** {**access-list** *acl-name* | **ip dscp** *dscp* |
ip precedence *ip-precedence* | **vlan** *vlan*}

acl-name - Name of the access control list. Any type of ACL can be specified, including standard or extended IP ACLs and MAC ACLs. (Range: 1-16 characters)

dscp - A Differentiated Service Code Point value. (Range: 0-63)

ip-precedence - An IP Precedence value. (Range: 0-7)

vlan - A VLAN. (Range:1-4093)

Default Setting

None

Command Mode

Class Map Configuration

Command Usage

- First enter the class-map command to designate a class map and enter the Class Map configuration mode. Then use **match** commands to specify the fields within ingress packets that must match to qualify for this class map.
- If an ingress packet matches an ACL specified by this command, any deny rules included in the ACL will be ignored.
- If match criteria includes an IP ACL or IP priority rule, then a VLAN rule cannot be included in the same class map.
- If match criteria includes a MAC ACL or VLAN rule, then neither an IP ACL nor IP priority rule can be included in the same class map.
- Up to 16 match entries can be included in a class map.

Example

This example creates a class map called "rd-class#1," and sets it to match packets marked for DSCP service value 3.

```
SSE-G2252(config)#class-map rd-class#1 match-any
SSE-G2252(config-cmap)#match ip dscp 3
SSE-G2252(config-cmap)#
```

This example creates a class map call "rd-class#2," and sets it to match packets marked for IP Precedence service value 5.

```
SSE-G2252(config)#class-map rd-class#2 match-any
SSE-G2252(config-cmap)#match ip precedence 5
SSE-G2252(config-cmap)#
```

This example creates a class map call “rd-class#3,” and sets it to match packets marked for VLAN 1.

```
SSE-G2252(config)#class-map rd-class#3 match-any
SSE-G2252(config-cmap)#match vlan 1
SSE-G2252(config-cmap)#
```

rename

This command redefines the name of a class map or policy map.

Syntax

rename *map-name*

map-name - Name of the class map or policy map.
(Range: 1-16 characters)

Command Mode

Class Map Configuration

Policy Map Configuration

Example

```
SSE-G2252(config)#class-map rd-class#1
SSE-G2252(config-cmap)#rename rd-class#9
SSE-G2252(config-cmap)#
```

policy-map

This command creates a policy map that can be attached to multiple interfaces, and enters Policy Map configuration mode. Use the **no** form to delete a policy map.

Syntax

[**no**] **policy-map** *policy-map-name*

policy-map-name - Name of the policy map.
(Range: 1-32 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Use the **policy-map** command to specify the name of the policy map, and then use the class command to configure policies for traffic that matches the criteria defined in a class map.
- A policy map can contain multiple class statements that can be applied to the same interface with the service-policy command.
- Create a Class Map ("policy-map" on page 37-6) before assigning it to a Policy Map.

Example

This example creates a policy called "rd-policy," uses the class command to specify the previously defined "rd-class," uses the **set** command to classify the service that incoming packets will receive, and then uses the police flow command to limit the average bandwidth to 100,000 Kbps, the burst rate to 4000 bytes, and configure the response to drop any violating packets.

```
SSE-G2252(config)#policy-map rd-policy
SSE-G2252(config-pmap)#class rd-class
SSE-G2252(config-pmap-c)#set ip dscp 3
SSE-G2252(config-pmap-c)#police flow 10000 4000 conform-action transmit
violate-action drop
SSE-G2252(config-pmap-c)#
```

class

This command defines a traffic classification upon which a policy can act, and enters Policy Map Class configuration mode. Use the **no** form to delete a class map.

Syntax

[**no**] **class** *class-map-name*

class-map-name - Name of the class map. (Range: 1-16 characters)

Default Setting

None

Command Mode

Policy Map Configuration

Command Usage

- Use the policy-map command to specify a policy map and enter Policy Map configuration mode. Then use the **class** command to enter Policy Map Class configuration mode. And finally, use the **set** command and one of the **police** commands to specify the match criteria, where the:
  - set phb command sets the per-hop behavior value in matching packets. (This modifies packet priority for internal processing only.)
  - set cos command sets the class of service value in matching packets. (This modifies packet priority in the VLAN tag.)
  - set ip dscp command sets the IP DSCP value in matching packets. (This modifies packet priority in the IP header.)
  - **police** commands define parameters such as the maximum throughput, burst rate, and response to non-conforming traffic.
- Up to 16 classes can be included in a policy map.

Example

This example creates a policy called “rd-policy,” uses the **class** command to specify the previously defined “rd-class,” uses the set phb command to classify the service that incoming packets will receive, and then uses the police flow command to limit the average bandwidth to 100,000 Kbps, the burst rate to 4,000 bytes, and configure the response to drop any violating packets.

```
SSE-G2252(config)#policy-map rd-policy
SSE-G2252(config-pmap)#class rd-class
SSE-G2252(config-pmap-c)#set phb 3
SSE-G2252(config-pmap-c)#police flow 10000 4000 conform-action transmit
violate-action drop
SSE-G2252(config-pmap-c)#
```

police flow

This command defines an enforcer for classified traffic based on the metered flow rate. Use the **no** form to remove a policer.

Syntax

[**no**] **police flow** *committed-rate committed-burst*
conform-action transmit
violate-action {**drop**| *new-dscp*}

committed-rate - Committed information rate (CIR) in kilobits per second. (Range: 64-1000000 kbps at a granularity of 64 kbps or maximum port speed, whichever is lower)

committed-burst - Committed burst size (BC) in bytes. (Range: 4000-16000000 at a granularity of 4k bytes)

conform-action - Action to take when packet is within the CIR and BC. (There are enough tokens to service the packet, the packet is set green).

violate-action - Action to take when packet exceeds the CIR and BC. (There are not enough tokens to service the packet, the packet is set red).

transmit - Transmits without taking any action.

drop - Drops packet as required by violate-action.

new-dscp - Differentiated Service Code Point (DSCP) value. (Range: 0-63)

Default Setting

None

Command Mode

Policy Map Class Configuration

Command Usage

- You can configure up to 16 policers (i.e., class maps) for ingress ports.
- The *committed-rate* cannot exceed the configured interface speed, and the *committed-burst* cannot exceed 16 Mbytes.
- Policing is based on a token bucket, where bucket depth (i.e., the maximum burst before the bucket overflows) is by specified the *committed-burst* field, and the average rate tokens are added to the bucket is by specified by the *committed-rate* option. Note that the token bucket functions similar to that described in RFC 2697 and RFC 2698.
- The behavior of the meter is specified in terms of one token bucket (C), the rate at which the tokens are incremented (CIR – Committed Information Rate), and the maximum size of the token bucket (BC – Committed Burst Size).

The token bucket C is initially full, that is, the token count Tc(0) = BC. Thereafter, the token count Tc is updated CIR times per second as follows:

- If Tc is less than BC, Tc is incremented by one
- Otherwise Tc is not incremented.

When a packet of size B bytes arrives at time t, the following happens:

- If Tc(t)-B ≥ 0, the packet is green and Tc is decremented by B down to the minimum value of 0
- Otherwise the packet is red and Tc is not decremented

Example

This example creates a policy called “rd-policy,” uses the class command to specify the previously defined “rd-class,” uses the set phb command to classify the service that incoming packets will receive, and then uses the **police flow** command to limit the average bandwidth to 100,000 Kbps, the burst rate to 4000 bytes, and configure the response to drop any violating packets.

```
SSE-G2252(config)#policy-map rd-policy
SSE-G2252(config-pmap)#class rd-class
SSE-G2252(config-pmap-c)#set phb 3
SSE-G2252(config-pmap-c)#police flow 100000 4000 conform-action transmit
violate-action drop
SSE-G2252(config-pmap-c)#
```

police srtcm-color

This command defines an enforcer for classified traffic based on a single rate three color meter (srTCM). Use the **no** form to remove a policer.

Syntax

[**no**] **police** {**srtcm-color-blind** | **srtcm-color-aware**}
committed-rate committed-burst excess-burst
conform-action transmit
exceed-action {**drop** | *new-dscp*}
violate action {**drop** | *new-dscp*}

srtcm-color-blind - Single rate three color meter in color-blind mode.

srtcm-color-aware - Single rate three color meter in color-aware mode.

committed-rate - Committed information rate (CIR) in kilobits per second.
(Range: 64-1000000 kbps at a granularity of 64 kbps or maximum port speed, whichever is lower)

committed-burst - Committed burst size (BC) in bytes.
(Range: 4000-16000000 at a granularity of 4k bytes)

excess-burst - Excess burst size (BE) in bytes.
(Range: 4000-1600000 at a granularity of 4k bytes)

conform-action - Action to take when rate is within the CIR and BC. (There are enough tokens in bucket BC to service the packet, packet is set green).

exceed-action - Action to take when rate exceeds the CIR and BC but is within the BE. (There are enough tokens in bucket BE to service the packet, the packet is set yellow.)

violate-action - Action to take when rate exceeds the BE. (There are not enough tokens in bucket BE to service the packet, the packet is set red.)

transmit - Transmits without taking any action.

drop - Drops packet as required by exceed-action or violate-action.

new-dscp - Differentiated Service Code Point (DSCP) value. (Range: 0-63)

Default Setting

None

Command Mode

Policy Map Class Configuration

Command Usage

- You can configure up to 16 policers (i.e., class maps) for ingress ports.
- The *committed-rate* cannot exceed the configured interface speed, and the *committed-burst* and *excess-burst* cannot exceed 16 Mbytes.
- The srTCM as defined in RFC 2697 meters a traffic stream and processes its packets according to three traffic parameters – Committed Information Rate (CIR), Committed Burst Size (BC), and Excess Burst Size (BE).
- The PHB label is composed of five bits, three bits for per-hop behavior, and two bits for the color scheme used to control queue congestion. A packet is marked green if it doesn't exceed the CIR and BC, yellow if it does exceed the CIR and BC, but not the BE, and red otherwise.
- The meter operates in one of two modes. In the color-blind mode, the meter assumes that the packet stream is uncolored. In color-aware mode the meter assumes that some preceding entity has pre-colored the incoming packet stream so that each packet is either green, yellow, or red. The marker (re)colors an IP packet according to the results of the meter. The color is coded in the DS field [RFC 2474] of the packet.
- The behavior of the meter is specified in terms of its mode and two token buckets, C and E, which both share the common rate CIR. The maximum size of the token bucket C is BC and the maximum size of the token bucket E is BE.

  The token buckets C and E are initially full, that is, the token count Tc(0) = BC and the token count Te(0) = BE. Thereafter, the token counts Tc and Te are updated CIR times per second as follows:

- If Tc is less than BC, Tc is incremented by one
- If Te is less then BE, Te is incremented by one
- Otherwise neither Tc nor Te is incremented

When a packet of size B bytes arrives at time t, the following happens if srTCM is configured to operate in color-blind mode:

- If Tc(t)-B ≥ 0, the packet is green and Tc is decremented by B down to the minimum value of 0
- If Te(t)-B ≥ 0, the packets is yellow and Te is decremented by B down to the minimum value of 0
- Otherwise the packet is red and neither Tc nor Te is decremented

When a packet of size B bytes arrives at time t, the following happens if srTCM is configured to operate in color-aware mode:

- If the packet has been precolored as green and Tc(t)-B ≥ 0, the packet is green and Tc is decremented by B down to the minimum value of 0
- If the packet has been precolored as yellow or green and if Te(t)-B ≥ 0, the packets is yellow and Te is decremented by B down to the minimum value of 0
- Otherwise the packet is red and neither Tc nor Te is decremented

The metering policy guarantees a deterministic behavior where the volume of green packets is never smaller than what has been determined by the CIR and BC, that is, tokens of a given color are always spent on packets of that color. Refer to RFC 2697 for more information on other aspects of srTCM.

Example

This example creates a policy called “rd-policy,” uses the class command to specify the previously defined “rd-class,” uses the set phb command to classify the service that incoming packets will receive, and then uses the **police srtcm-color-blind** command to limit the average bandwidth to 100,000 Kbps, the committed burst rate to 4000 bytes, the excess burst rate to 6000 bytes, to remark any packets exceeding the committed burst size, and to drop any packets exceeding the excess burst size.

```
SSE-G2252(config)#policy-map rd-policy
SSE-G2252(config-pmap)#class rd-class
SSE-G2252(config-pmap-c)#set phb 3
SSE-G2252(config-pmap-c)#police srtcm-color-blind 100000 4000 6000
conform-action transmit exceed-action 0 violate-action drop
SSE-G2252(config-pmap-c)#
```

police trtcm-color

This command defines an enforcer for classified traffic based on a two rate three color meter (trTCM). Use the **no** form to remove a policer.

Syntax

[**no**] **police** {**trtcm-color-blind** | **trtcm-color-aware**}
committed-rate committed-burst peak-rate peak-burst
conform-action transmit
exceed-action {**drop** | *new-dscp*}
violate action {**drop** | *new-dscp*}

trtcm-color-blind - Two rate three color meter in color-blind mode.

trtcm-color-aware - Two rate three color meter in color-aware mode.

committed-rate - Committed information rate (CIR) in kilobits per second. (Range: 64-1000000 kbps at a granularity of 64 kbps or maximum port speed, whichever is lower)

committed-burst - Committed burst size (BC) in bytes. (Range: 4000-16000000 at a granularity of 4k bytes)

peak-rate - Peak information rate (PIR) in kilobits per second. (Range: 64-1000000 kbps at a granularity of 64 kbps or maximum port speed, whichever is lower)

peak-burst - Peak burst size (BP) in bytes. (Range: 4000-16000000 at a granularity of 4k bytes)

conform-action - Action to take when rate is within the CIR and BP. (Packet size does not exceed BP and there are enough tokens in bucket BC to service the packet, the packet is set green.)

exceed-action - Action to take when rate exceeds the CIR but is within the PIR. (Packet size exceeds BC but there are enough tokens in bucket BP to service the packet, the packet is set yellow.)

violate-action - Action to take when rate exceeds the PIR. (There are not enough tokens in bucket BP to service the packet, the packet is set red.)

drop - Drops packet as required by exceed-action or violate-action.

transmit - Transmits without taking any action.

new-dscp - Differentiated Service Code Point (DSCP) value. (Range: 0-63)

Default Setting

None

Command Mode

Policy Map Class Configuration

Command Usage

- You can configure up to 16 policers (i.e., class maps) for ingress ports.
- The *committed-rate* and *peak-rate* cannot exceed the configured interface speed, and the *committed-burst* and *peak-burst* cannot exceed 16 Mbytes.
- The trTCM as defined in RFC 2698 meters a traffic stream and processes its packets based on two rates – Committed Information Rate (CIR) and Peak Information Rate (PIR), and their associated burst sizes - Committed Burst Size (BC) and Peak Burst Size (BP).
- The PHB label is composed of five bits, three bits for per-hop behavior, and two bits for the color scheme used to control queue congestion. A packet is marked red if it exceeds the PIR. Otherwise it is marked either yellow or green depending on whether it exceeds or doesn't exceed the CIR.

  The trTCM is useful for ingress policing of a service, where a peak rate needs to be enforced separately from a committed rate.
- The meter operates in one of two modes. In the color-blind mode, the meter assumes that the packet stream is uncolored. In color-aware mode the meter assumes that some preceding entity has pre-colored the incoming packet stream so that each packet is either green, yellow, or red. The marker (re)colors an IP packet according to the results of the meter. The color is coded in the DS field [RFC 2474] of the packet.
- The behavior of the meter is specified in terms of its mode and two token buckets, P and C, which are based on the rates PIR and CIR, respectively. The maximum size of the token bucket P is BP and the maximum size of the token bucket C is BC.
- The token buckets P and C are initially (at time 0) full, that is, the token count Tp(0) = BP and the token count Tc(0) = BC. Thereafter, the token count Tp is incremented by one PIR times per second up to BP and the token count Tc is incremented by one CIR times per second up to BC.

  When a packet of size B bytes arrives at time t, the following happens if trTCM is configured to operate in color-blind mode:

  - If Tp(t)-B < 0, the packet is red
  - If Tc(t)-B < 0, the packet is yellow and Tp is decremented by B
  - Othewise the packet is green and both Tp and Tc are decremented by B

  When a packet of size B bytes arrives at time t, the following happens if trTCM is configured to operate in color-aware mode:

  - If the packet has been precolored as red or if Tp(t)-B < 0, the packet is red
  - If the packet has been precolored as yellow or if Tc(t)-B < 0, the packet is yellow and Tp is decremented by B
  - Otherwise the packet is green and both Tp and Tc are decremented by B

- The trTCM can be used to mark a IP packet stream in a service, where different, decreasing levels of assurances (either absolute or relative) are given to packets which are green, yellow, or red. Refer to RFC 2698 for more information on other aspects of trTCM.

Example

This example creates a policy called "rd-policy," uses the class command to specify the previously defined "rd-class," uses the set phb command to classify the service that incoming packets will receive, and then uses the **police trtcm-color-blind** command to limit the average bandwidth to 100,000 Kbps, the committed burst rate to 4000 bytes, the peak information rate to 1,000,000 kbps, the peak burst size to 6000, to remark any packets exceeding the committed burst size, and to drop any packets exceeding the peak information rate.

```
SSE-G2252(config)#policy-map rd-policy
SSE-G2252(config-pmap)#class rd-class
SSE-G2252(config-pmap-c)#set phb 3
SSE-G2252(config-pmap-c)#police trtcm-color-blind 100000 4000 100000 6000
conform-action transmit exceed-action 0 violate-action drop
SSE-G2252(config-pmap-c)#
```

set cos

This command modifies the class of service (CoS) value for a matching packet (as specified by the match command) in the packet's VLAN tag. Use the **no** form to remove this setting.

Syntax

[**no**] **set cos** *cos-value*

cos-value - Class of Service value. (Range: 0-7)

Default Setting

None

Command Mode

Policy Map Class Configuration

Command Usage

- The **set cos** command is used to set the CoS value in the VLAN tag for matching packets.
- The **set cos** and set phb command function at the same level of priority. Therefore setting either of these commands will overwrite any action already configured by the other command.

Example

This example creates a policy called “rd-policy,” uses the class command to specify the previously defined “rd-class,” uses the **set cos** command to classify the service that incoming packets will receive, and then uses the police flow command to limit the average bandwidth to 100,000 Kbps, the burst rate to 4000 bytes, and configure the response to drop any violating packets.

```
SSE-G2252(config)#policy-map rd-policy
SSE-G2252(config-pmap)#class rd-class
SSE-G2252(config-pmap-c)#set cos 3
SSE-G2252(config-pmap-c)#police flow 10000 4000 conform-action transmit
violate-action drop
SSE-G2252(config-pmap-c)#
```

set ip dscp

This command modifies the IP DSCP value in a matching packet (as specified by the match command). Use the **no** form to remove this traffic classification.

Syntax

[**no**] **set dscp** *new-dscp*

new-dscp - New Differentiated Service Code Point (DSCP) value. (Range: 0-63)

Default Setting

None

Command Mode

Policy Map Class Configuration

Command Usage

The **set ip dscp** command is used to set the priority values in the packet’s ToS field for matching packets.

Example

This example creates a policy called “rd-policy,” uses the class command to specify the previously defined “rd-class,” uses the **set ip dscp** command to classify the service that incoming packets will receive, and then uses the police flow command to limit the average bandwidth to 100,000 Kbps, the burst rate to 4000 bytes, and configure the response to drop any violating packets.

```
SSE-G2252(config)#policy-map rd-policy
SSE-G2252(config-pmap)#class rd-class
SSE-G2252(config-pmap-c)#set dscp 3
SSE-G2252(config-pmap-c)#police flow 10000 4000 conform-action transmit
violate-action drop
SSE-G2252(config-pmap-c)#
```

set phb

This command services IP traffic by setting a per-hop behavior value for a matching packet (as specified by the match command) for internal processing. Use the **no** form to remove this setting.

Syntax

[**no**] **set phb** *phb-value*

phb-value - Per-hop behavior value. (Range: 0-7)

Default Setting

None

Command Mode

Policy Map Class Configuration

Command Usage

- The **set phb** command is used to set an internal QoS value in hardware for matching packets (see Table 36-5: "Default Mapping of DSCP Values to Internal PHB/Drop Values" on page 36-9). The QoS label is composed of five bits, three bits for per-hop behavior, and two bits for the color scheme used to control queue congestion by the police srtcm-color command and police trtcm-color command.
- The set cos and **set phb** command function at the same level of priority. Therefore setting either of these commands will overwrite any action already configured by the other command.

Example

This example creates a policy called "rd-policy," uses the class command to specify the previously defined "rd-class," uses the **set phb** command to classify the service that incoming packets will receive, and then uses the police flow command to limit the average bandwidth to 100,000 Kbps, the burst rate to 4000 bytes, and configure the response to drop any violating packets.

```
SSE-G2252(config)#policy-map rd-policy
SSE-G2252(config-pmap)#class rd-class
SSE-G2252(config-pmap-c)#set phb 3
SSE-G2252(config-pmap-c)#police flow 10000 4000 conform-action transmit
violate-action drop
SSE-G2252(config-pmap-c)#
```

service-policy

This command applies a policy map defined by the **policy-map** command to the ingress side of a particular interface. Use the **no** form to remove this mapping.

Syntax

[**no**] **service-policy input** *policy-map-name*

input - Apply to the input traffic.

policy-map-name - Name of the policy map for this interface. (Range: 1-32 characters)

Default Setting

No policy map is attached to an interface.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Only one policy map can be assigned to an interface.
- First define a class map, then define a policy map, and finally use the **service-policy** command to bind the policy map to the required interface.
- The switch does not allow a policy map to be bound to an interface for egress traffic.

Example

This example applies a service policy to an ingress interface.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#service-policy input rd-policy
SSE-G2252(config-if)#
```

show class-map

This command displays the QoS class maps which define matching criteria used for classifying traffic.

Syntax

show class-map [*class-map-name*]

class-map-name - Name of the class map. (Range: 1-32 characters)

Default Setting

Displays all class maps.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show class-map
Class Map match-any rd-class#1
Description:
 Match ip dscp 10
 Match access-list rd-access
 Match ip dscp 0

Class Map match-any rd-class#2
 Match ip precedence 5

Class Map match-any rd-class#3
 Match vlan 1

SSE-G2252#
```

show policy-map

This command displays the QoS policy maps which define classification criteria for incoming traffic, and may include policers for bandwidth limitations.

Syntax

show policy-map [*policy-map-name* [**class** *class-map-name*]]

policy-map-name - Name of the policy map. (Range: 1-16 characters)

class-map-name - Name of the class map. (Range: 1-16 characters)

Default Setting

Displays all policy maps and all classes.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show policy-map
Policy Map rd-policy
Description:
 class rd-class
 set phb 3
SSE-G2252#show policy-map rd-policy class rd-class
Policy Map rd-policy
 class rd-class
 set phb 3
SSE-G2252#
```

show policy-map interface

This command displays the service policy assigned to the specified interface.

Syntax

show policy-map interface *interface* **input**

interface

unit/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show policy-map interface 1/5 input
Service-policy rd-policy
SSE-G2252#
```

Chapter 38
Multicast Filtering Commands

This switch uses IGMP (Internet Group Management Protocol) to check for any attached hosts that want to receive a specific multicast service. It identifies the ports containing hosts requesting a service and sends data out to those ports only. It then propagates the service request up to any neighboring multicast switch/router to ensure that it will continue to receive the multicast service.

Table 38-1. Multicast Filtering Commands

Command Group	Function
IGMP Snooping	Configures multicast groups via IGMP snooping or static assignment, sets the IGMP version, enables proxy reporting, displays current snooping settings, and displays the multicast service and group members
Static Multicast Routing	Configures static multicast router ports which forward all inbound multicast traffic to the attached VLANs
IGMP Filtering and Throttling	Configures IGMP filtering and throttling
Multicast VLAN Registration	Configures a single network-wide multicast VLAN shared by hosts residing in other standard or private VLAN groups, preserving security and data isolation for normal traffic

38-1 IGMP Snooping

This section describes commands used to configure IGMP snooping on the switch.

Table 38-2. IGMP Snooping Commands

Command	Function	Mode
ip igmp snooping	Enables IGMP snooping	GC
ip igmp snooping proxy-reporting	Enables IGMP Snooping with Proxy Reporting	GC
ip igmp snooping querier	Allows this device to act as the querier for IGMP snooping	GC
ip igmp snooping router-alert-option-check	Discards any IGMPv2/v3 packets that do not include the Router Alert option	GC
ip igmp snooping router-port-expire-time	Configures the querier timeout	GC
ip igmp snooping tcn-flood	Floods multicast traffic when a Spanning Tree topology change occurs	GC
ip igmp snooping tcn-query-solicit	Sends an IGMP Query Solicitation when a Spanning Tree topology change occurs	GC
ip igmp snooping unregistered-data-flood	Floods unregistered multicast traffic into the attached VLAN	GC

Table 38-2. IGMP Snooping Commands (Continued)

Command	Function	Mode
ip igmp snooping unsolicited-report-interval	Specifies how often the upstream interface should transmit unsolicited IGMP reports (when proxy reporting is enabled)	GC
ip igmp snooping version	Configures the IGMP version for snooping	GC
ip igmp snooping version-exclusive	Discards received IGMP messages which use a version different to that currently configured	GC
ip igmp snooping vlan general-query-suppression	Suppresses general queries except for ports attached to downstream multicast hosts	GC
ip igmp snooping vlan immediate-leave	Immediately deletes a member port of a multicast service if a leave packet is received at that port and immediate-leave is enabled for the parent VLAN	GC
ip igmp snooping vlan last-memb-query-count	Configures the number of IGMP proxy query messages that are sent out before the system assumes there are no local members	GC
ip igmp snooping vlan last-memb-query-intvl	Configures the last-member-query interval	GC
ip igmp snooping vlan mrd	Sends multicast router solicitation messages	GC
ip igmp snooping vlan proxy-address	Configures a static address for proxy IGMP query and reporting	GC
ip igmp snooping vlan proxy-query-interval	Configures the interval between sending IGMP proxy general queries	GC
ip igmp snooping vlan proxy-query-resp-intvl	Configures the maximum time the system waits for a response to proxy general queries	GC
ip igmp snooping proxy-reporting	Enables IGMP Snooping with Proxy Reporting	GC
ip igmp snooping vlan static	Adds an interface as a member of a multicast group	GC
ip igmp snooping version	Configures the IGMP version for snooping	GC
ip igmp snooping version-exclusive	Discards received IGMP messages which use a version different to that currently configured	GC
show ip igmp snooping	Shows the IGMP snooping, proxy, and query configuration	PE
show ip igmp snooping group	Shows known multicast group, source, and host port mapping	PE

ip igmp snooping

This command enables IGMP snooping globally on the switch or on a selected VLAN interface. Use the **no** form to disable it.

Syntax

[**no**] **ip igmp snooping** [**vlan** *vlan-id*]

vlan-id - VLAN ID (Range: 1-4093)

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- When IGMP snooping is enabled globally, the per VLAN interface settings for IGMP snooping take precedence.
- When IGMP snooping is disabled globally, snooping can still be configured per VLAN interface, but the interface settings will not take effect until snooping is re-enabled globally.

Example

The following example enables IGMP snooping globally.

```
SSE-G2252(config)#ip igmp snooping
SSE-G2252(config)#
```

ip igmp snooping proxy-reporting

This command enables IGMP Snooping with Proxy Reporting. Use the **no** form to restore the default setting.

Syntax

[**no**] **ip igmp snooping proxy-reporting**

ip igmp snooping vlan *vlan-id* **proxy-reporting** {**enable** | **disable**}

no ip igmp snooping vlan *vlan-id* **proxy-reporting**

vlan-id - VLAN ID (Range: 1-4093)

enable - Enable on the specified VLAN.

disable - Disable on the specified VLAN.

Default Setting

Global: Enabled

VLAN: Based on global setting

Command Mode

Global Configuration

Command Usage

- When proxy reporting is enabled with this command, the switch performs "IGMP Snooping with Proxy Reporting" (as defined in DSL Forum TR-101, April 2006), including last leave, and query suppression. Last leave sends out a proxy query when the last member leaves a multicast group, and query suppression means that neither specific queries nor general queries are forwarded from an upstream multicast router to hosts downstream from this device.
- If the IGMP proxy reporting is configured on a VLAN, this setting takes precedence over the global configuration.

Example

```
SSE-G2252(config)#ip igmp snooping proxy-reporting
SSE-G2252(config)#
```

ip igmp snooping querier

This command enables the switch as an IGMP querier. Use the **no** form to disable it.

Syntax

[**no**] **ip igmp snooping querier**

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

- IGMP snooping querier is not supported for IGMPv3 snooping (see ip igmp snooping version).
- If enabled, the switch will serve as querier if elected. The querier is responsible for asking hosts if they want to receive multicast traffic.

Example

```
SSE-G2252(config)#ip igmp snooping querier
SSE-G2252(config)#
```

ip igmp snooping router-alert-option-check

This command discards any IGMPv2/v3 packets that do not include the Router Alert option. Use the **no** form to ignore the Router Alert Option when receiving IGMP messages.

Syntax

[**no**] **ip igmp snooping router-alert-option-check**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

As described in Section 9.1 of RFC 3376 for IGMP Version 3, the Router Alert Option can be used to protect against DOS attacks. One common method of attack is launched by an intruder who takes over the role of querier, and starts overloading multicast hosts by sending a large number of group-and-source-specific queries, each with the Maximum Response Time set to a large value.

To protect against this kind of attack, (1) routers should not forward queries. This is easier to accomplish if the query carries the Router Alert option. (2) Also, when the switch is acting in the role of a multicast host (such as when using proxy routing), it should ignore version 2 or 3 queries that do not contain the Router Alert option.

Example

```
SSE-G2252(config)#ip igmp snooping router-alert-option-check
SSE-G2252(config)#
```

ip igmp snooping router-port-expire-time

This command configures the querier time out. Use the **no** form to restore the default.

Syntax

ip igmp snooping router-port-expire-time *seconds*

no ip igmp snooping router-port-expire-time

seconds - The time the switch waits after the previous querier stops before it considers it to have expired. (Range: 1-65535; Recommended Range: 300-500)

Default Setting

300 seconds

Command Mode

Global Configuration

Example

The following shows how to configure the time out to 400 seconds:

```
SSE-G2252(config)#ip igmp snooping router-port-expire-time 400
SSE-G2252(config)#
```

ip igmp snooping tcn-flood

This command enables flooding of multicast traffic if a spanning tree topology change notification (TCN) occurs. Use the **no** form to disable flooding.

Syntax

[**no**] **ip igmp snooping tcn-flood**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- When a spanning tree topology change occurs, the multicast membership information learned by the switch may be out of date. For example, a host linked to one port before the topology change (TC) may be moved to another port after the change. To ensure that multicast data is delivered to all receivers, by default, a switch in a VLAN (with IGMP snooping enabled) that receives a Bridge Protocol Data Unit (BPDU) with the TC bit set (by the root bridge) will enter into "multicast flooding mode" for a period of time until the topology has stabilized and the new locations of all multicast receivers are learned.
- If a topology change notification (TCN) is received, and all the uplink ports are subsequently deleted, a time out mechanism is used to delete all of the currently learned multicast channels.
- When a new uplink port starts up, the switch sends unsolicited reports for all current learned channels out through the new uplink port.
- By default, the switch immediately enters into "multicast flooding mode" when a spanning tree topology change occurs. In this mode, multicast traffic will be flooded to all VLAN ports. If many ports have subscribed to different multicast groups, flooding may cause excessive loading on the link between the switch and the end host. Flooding may be disabled to avoid this, causing multicast traffic to be delivered only to those ports on which multicast group members have been learned.
- When the spanning tree topology changes, the root bridge sends a proxy query to quickly re-learn the host membership/port relations for multicast channels. The root bridge also sends an unsolicited Multicast Router Discover (MRD) request to quickly locate the multicast routers in this VLAN.

  The proxy query and unsolicited MRD request are flooded to all VLAN ports except for the receiving port when the switch receives such packets.

Example

The following example enables TCN flooding.

```
SSE-G2252(config)#ip igmp snooping tcn-flood
SSE-G2252(config)#
```

ip igmp snooping tcn-query-solicit

This command instructs the switch to send out an IGMP general query solicitation when a spanning tree topology change notification (TCN) occurs. Use the **no** form to disable this feature.

Syntax

[**no**] **ip igmp snooping tcn-query-solicit**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- When the root bridge in a spanning tree receives a topology change notification for a VLAN where IGMP snooping is enabled, it issues a global IGMP leave message (query solicitation). When a switch receives this solicitation, it floods it to all ports in the VLAN where the spanning tree change occurred. When an upstream multicast router receives this solicitation, it will also immediately issues an IGMP general query.
- The **ip igmp snooping tcn query-solicit** command can be used to send a query solicitation whenever it notices a topology change, even if the switch is not the root bridge in the spanning tree.

Example

The following example instructs the switch to issue an IGMP general query whenever it receives a spanning tree topology change notification.

```
SSE-G2252(config)#ip igmp snooping tcn query-solicit
SSE-G2252(config)#
```

ip igmp snooping unregistered-data-flood

This command floods unregistered multicast traffic into the attached VLAN. Use the **no** form to drop unregistered multicast traffic.

Syntax

[**no**] **ip igmp snooping unregistered-data-flood**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

Once the table used to store multicast entries for IGMP snooping and multicast routing is filled, no new entries are learned. If no router port is configured in the attached VLAN, and unregistered-flooding is disabled, any subsequent multicast traffic not found in the table is dropped, otherwise it is flooded throughout the VLAN.

Example

```
SSE-G2252(config)#ip igmp snooping unregistered-data-flood
SSE-G2252(config)#
```

ip igmp snooping unsolicited-report-interval

This command specifies how often the upstream interface should transmit unsolicited IGMP reports when proxy reporting is enabled. Use the **no** form to restore the default value.

Syntax

ip igmp snooping unsolicited-report-interval *seconds*

no ip igmp snooping version-exclusive

seconds - The interval at which to issue unsolicited reports. (Range: 1-65535 seconds)

Default Setting

400 seconds

Command Mode

Global Configuration

Command Usage

- When a new upstream interface (that is, uplink port) starts up, the switch sends unsolicited reports for all currently learned multicast channels out through the new upstream interface.
- This command only applies when proxy reporting is enabled (see "ip igmp snooping proxy-reporting" on page 38-4).

Example

```
SSE-G2252(config)#ip igmp snooping unsolicited-report-interval 5
SSE-G2252(config)#
```

ip igmp snooping version

This command configures the IGMP snooping version. Use the **no** form to restore the default.

Syntax

ip igmp snooping [**vlan** *vlan-id*] **version** {**1** | **2** | **3**}

no ip igmp snooping version

vlan-id - VLAN ID (Range: 1-4093)

1 - IGMP Version 1

2 - IGMP Version 2

3 - IGMP Version 3

Default Setting

Global: IGMP Version 2

VLAN: Not configured, based on global setting

Command Mode

Global Configuration

Command Usage

- This command configures the IGMP report/query version used by IGMP snooping. Versions 1 - 3 are all supported, and versions 2 and 3 are backward compatible, so the switch can operate with other devices, regardless of the snooping version employed.
- If the IGMP snooping version is configured on a VLAN, this setting takes precedence over the global configuration.

Example

The following configures the global setting for IGMP snooping to version 1.

```
SSE-G2252(config)#ip igmp snooping version 1
SSE-G2252(config)#
```

ip igmp snooping version-exclusive

This command discards any received IGMP messages (except for multicast protocol packets) which use a version different to that currently configured by the ip igmp snooping version command. Use the **no** form to disable this feature.

Syntax

ip igmp snooping [**vlan** *vlan-id*] **version-exclusive**

no ip igmp snooping version-exclusive

vlan-id - VLAN ID (Range: 1-4093)

Default Setting

Global: Disabled

VLAN: Disabled

Command Mode

Global Configuration

Command Usage

- If version exclusive is disabled on a VLAN, then this setting is based on the global setting. If it is enabled on a VLAN, then this setting takes precedence over the global setting.
- When this function is disabled, the currently selected version is backward compatible (see the ip igmp snooping version command.

Example

```
SSE-G2252(config)#ip igmp snooping version-exclusive
SSE-G2252(config)#
```

ip igmp snooping vlan general-query-suppression

This command suppresses general queries except for ports attached to downstream multicast hosts. Use the **no** form to flood general queries to all ports except for the multicast router port.

Syntax

[**no**] **ip igmp snooping vlan** *vlan-id* **general-query-suppression**

vlan-id - VLAN ID (Range: 1-4093)

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- By default, general query messages are flooded to all ports, except for the multicast router through which they are received.
- If general query suppression is enabled, then these messages are forwarded only to downstream ports which have joined a multicast service.

Example

```
SSE-G2252(config)#ip igmp snooping vlan 1 general-query-suppression
SSE-G2252(config)#
```

ip igmp snooping vlan immediate-leave

This command immediately deletes a member port of a multicast service if a leave packet is received at that port and immediate-leave is enabled for the parent VLAN. Use the **no** form to restore the default.

Syntax

[**no**] **ip igmp snooping vlan** *vlan-id* **immediate-leave**

vlan-id - VLAN ID (Range: 1-4093)

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- If immediate-leave is *not* used, a multicast router (or querier) will send a group-specific query message when an IGMPv2/v3 group leave message is received. The router/querier stops forwarding traffic for that group only if no host replies to the query within the time out period. (The time out for this release is currently defined by Last Member Query Interval (fixed at one second) * Robustness Variable (fixed at 2) as defined in RFC 2236.
- If immediate-leave is enabled, the switch assumes that only one host is connected to the interface. Therefore, immediate leave should only be enabled on an interface if it is connected to only one IGMP-enabled device, either a service host or a neighbor running IGMP snooping.
- This command is only effective if IGMP snooping is enabled, and IGMPv2 or IGMPv3 snooping is used.

Example

The following shows how to enable immediate leave.

```
SSE-G2252(config)#ip igmp snooping vlan 1 immediate-leave
SSE-G2252(config)#
```

ip igmp snooping vlan last-memb-query-count

This command configures the number of IGMP proxy group-specific or group-and-source-specific query messages that are sent out before the system assumes there are no more local members. Use the **no** form to restore the default.

Syntax

ip igmp snooping vlan *vlan-id* **last-memb-query-count** *count*

no ip igmp snooping vlan *vlan-id* **last-memb-query-count**

vlan-id - VLAN ID (Range: 1-4093)

count - The number of proxy group-specific or group-and-source-specific query messages to issue before assuming that there are no more group members. (Range: 1-255)

Default Setting

2

Command Mode

Global Configuration

Command Usage

This command will take effect only if IGMP snooping proxy reporting or IGMP querier is enabled ("ip igmp snooping proxy-reporting" on page 38-4).

Example

```
SSE-G2252(config)#ip igmp snooping vlan 1 last-memb-query-count 7
SSE-G2252(config)#
```

ip igmp snooping vlan last-memb-query-intvl

This command configures the last-member-query interval. Use the **no** form to restore the default.

Syntax

ip igmp snooping vlan *vlan-id* **last-memb-query-intvl** *interval*

no ip igmp snooping vlan *vlan-id* **last-memb-query-intvl**

vlan-id - VLAN ID (Range: 1-4093)

interval - The interval to wait for a response to a group-specific or group-and-source-specific query message. (Range: 1-31744 tenths of a second)

Default Setting

10 (1 second)

Command Mode

Global Configuration

Command Usage

- When a multicast host leaves a group, it sends an IGMP leave message. When the leave message is received by the switch, it checks to see if this host is the last to leave the group by sending out an IGMP group-specific query message, and starts a timer. If no reports are received before the timer expires, the group record is deleted, and a report is sent to the upstream multicast router.
- A reduced value will result in reduced time to detect the loss of the last member of a group or source, but may generate more bursty traffic.
- This command will take effect only if IGMP snooping proxy reporting is enabled ("ip igmp snooping proxy-reporting" on page 38-4).

Example

```
SSE-G2252(config)#ip igmp snooping vlan 1 last-memb-query-intvl 700
SSE-G2252(config)#
```

ip igmp snooping vlan mrd

This command enables sending of multicast router solicitation messages. Use the **no** form to disable these messages.

Syntax

[**no**] **ip igmp snooping vlan** *vlan-id* **mrd**

vlan-id - VLAN ID (Range: 1-4093)

Default Setting

Enabled

Command Mode

Global Configuration

Command Usage

- Multicast Router Discovery (MRD) uses multicast router advertisement, multicast router solicitation, and multicast router termination messages to discover multicast routers. Devices send solicitation messages in order to solicit advertisement messages from multicast routers. These messages are used to discover multicast routers on a directly attached link. Solicitation messages are also sent whenever a multicast forwarding interface is initialized or re-initialized. Upon receiving a solicitation on an interface with IP multicast forwarding and MRD enabled, a router will respond with an advertisement.
- Advertisements are sent by routers to advertise that IP multicast forwarding is enabled. These messages are sent unsolicited periodically on all router interfaces on which multicast forwarding is enabled. They are sent upon the expiration of a periodic timer, as a part of a router's start up procedure, during the restart of a multicast forwarding interface, and on receipt of a solicitation message. When the multicast services provided to a VLAN is relatively stable, the use of solicitation messages is not required and may be disabled using the **no ip igmp snooping vlan mrd** command.
- This command may also be used to disable multicast router solicitation messages when the upstream router does not support MRD, to reduce the loading on a busy upstream router, or when IGMP snooping is disabled in a VLAN.

Example

This example disables sending of multicast router solicitation messages on VLAN 1.

```
SSE-G2252(config)#no ip igmp snooping vlan 1 mrd
SSE-G2252(config)#
```

ip igmp snooping vlan proxy-address

This command configures a static source address for locally generated query and report messages used by IGMP proxy reporting. Use the **no** form to restore the default source address.

Syntax

[**no**] **ip igmp snooping vlan** *vlan-id* **proxy-address** *source-address*

vlan-id - VLAN ID (Range: 1-4093)

source-address - The source address used for proxied IGMP query and report, and leave messages. (Any valid IP unicast address)

Default Setting

0.0.0.0

Command Mode

Global Configuration

Command Usage

IGMP Snooping uses a null IP address of 0.0.0.0 for the source of IGMP query messages which are proxied to downstream hosts to indicate that it is not the elected querier, but is only proxying these messages as defined in RFC 4541. The switch also uses a null address in IGMP reports sent to upstream ports.

Many hosts do not implement RFC 4541, and therefore do not understand query messages with the source address of 0.0.0.0. These hosts will therefore not reply to the queries, causing the multicast router to stop sending traffic to them.

To resolve this problem, the source address in proxied IGMP query and report messages can be replaced with any valid unicast address (other than the router's own address) using this command.

Example

The following example sets the source address for proxied IGMP query messages to 10.0.1.8.

```
SSE-G2252(config)#ip igmp snooping vlan 1 proxy-address 10.0.1.8
SSE-G2252(config)#
```

ip igmp snooping vlan proxy-query-interval

This command configures the interval between sending IGMP proxy general queries. Use the **no** form to restore the default.

Syntax

ip igmp snooping vlan *vlan-id* **proxy-query-interval** *interval*

no ip igmp snooping vlan *vlan-id* **proxy-query-interval**

vlan-id - VLAN ID (Range: 1-4093)

interval - The interval between sending IGMP proxy general queries. (Range: 10-31744 seconds)

Default Setting

100 (10 seconds)

Command Mode

Global Configuration

Command Usage

- An IGMP general query message is sent by the switch at the interval specified by this command. When this message is received by downstream hosts, all receivers build an IGMP report for the multicast groups they have joined.
- This command will take effect only if IGMP snooping proxy reporting is enabled ("ip igmp snooping proxy-reporting" on page 38-4).

Example

```
SSE-G2252(config)#ip igmp snooping vlan 1 proxy-query-interval 150
SSE-G2252(config)#
```

ip igmp snooping vlan proxy-query-resp-intvl

This command configures the maximum time the system waits for a response to proxy general queries. Use the **no** form to restore the default.

Syntax

ip igmp snooping vlan *vlan-id* **proxy-query-resp-intvl** *interval*

no ip igmp snooping vlan *vlan-id* **proxy-query-resp-intvl**

vlan-id - VLAN ID (Range: 1-4093)

interval - The maximum time the system waits for a response to proxy general queries. (Range: 10-31744 tenths of a second)

Default Setting

100 (10 seconds)

Command Mode

Global Configuration

Command Usage

This command will take effect only if IGMP snooping proxy reporting is enabled ("ip igmp snooping proxy-reporting" on page 38-4).

Example

```
SSE-G2252(config)#ip igmp snooping vlan 1 proxy-query-resp-intvl 20
SSE-G2252(config)#
```

ip igmp snooping vlan static

This command adds a port to a multicast group. Use the **no** form to remove the port.

Syntax

[**no**] **ip igmp snooping vlan** *vlan-id* **static** *ip-address interface*

vlan-id - VLAN ID (Range: 1-4093)

ip-address - IP address for multicast group

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Static multicast entries are never aged out.
- When a multicast entry is assigned to an interface in a specific VLAN, the corresponding traffic can only be forwarded to ports within that VLAN.

Example

The following shows how to statically configure a multicast group on a port.

```
SSE-G2252(config)#ip igmp snooping vlan 1 static 224.0.0.12 ethernet 1/5
SSE-G2252(config)#
```

show ip igmp snooping

This command shows the IGMP snooping, proxy, and query configuration settings.

Command Mode

Privileged Exec

Command Usage

This command displays global and VLAN-specific IGMP configuration settings. See "Configuring IGMP Snooping and Query Parameters" on page 18-4 for a description of the displayed items.

Example

The following shows the current IGMP snooping configuration:

```
SSE-G2252#show ip igmp snooping
 IGMP snooping                        : Enabled
 Router port expire time              : 300 s
 Router alert check                   : Disabled
 TCN flood                            : Disabled
 TCN query solicit                    : Disabled
 Unregistered data flood              : Disabled
 Unsolicited report interval          : 400 s
 Version exclusive                    : Disabled
 Version                              : 2
 Proxy reporting                      : Enabled

 Vlan 1:
 --------
 IGMP snooping                        : Enabled
 IGMP snooping running status         : Inactive
 Version                              : Using global version (2)
 Version exclusive                    : Using global status (Disabled)
 Immediate leave                      : Disabled
 Last member query interval           : 10 (1/10s)
 Last member query count              : 2
 Proxy query address                  : 0.0.0.0
 General query suppression            : Disabled
 Query interval                       : 125 s
 Query response interval              : 100 (1/10s)
 Proxy reporting                      : Using global status (Enabled)
 Multicast Router Discovery           : Enabled
.
.
.
```

show ip igmp snooping group

This command shows known multicast group, source, and host port mappings for the specified VLAN interface, or for all interfaces if none is specified.

Syntax

show ip igmp snooping group [**vlan** *vlan-id* [**user** | **igmpsnp**]] [**user** | **igmpsnp**]

vlan-id - VLAN ID (1-4093)

user - Display only the user-configured multicast entries.

igmpsnp - Display only entries learned through IGMP snooping.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

Member types displayed include IGMP or USER, depending on selected options.

Example

```
Console#show ip igmp snooping group vlan 1
Bridge Multicast Forwarding Entry Count:0
VLAN     Group            Source           Port List
-------- ---------------- ----------------
---------------------------------
   1 224.1.1.12      *               Eth 1/12(S)
   1 224.1.1.12      *               Eth 1/23(D)
Console#
```

38-2 Static Multicast Routing

This section describes commands used to configure static multicast routing on the switch.

Table 38-3. Static Multicast Interface Commands

Command	Function	Mode
ip igmp snooping vlan mrouter	Adds a multicast router port	GC
show ip igmp snooping mrouter	Shows multicast router ports	PE

ip igmp snooping vlan mrouter

This command statically configures a (Layer 2) multicast router port on the specified VLAN. Use the **no** form to remove the configuration.

Syntax

[**no**] **ip igmp snooping vlan** *vlan-id* **mrouter** *interface*

vlan-id - VLAN ID (Range: 1-4093)

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

No static multicast router ports are configured.

Command Mode

Global Configuration

Command Usage

- Depending on your network connections, IGMP snooping may not always be able to locate the IGMP querier. Therefore, if the IGMP querier is a known multicast router or switch connected over the network to an interface (port or trunk) on this switch, that interface can be manually configured to join all the current multicast groups.
- IGMP Snooping must be enabled globally on the switch (using the ip igmp snooping command) before a multicast router port can take effect.

Example

The following shows how to configure port 11 as a multicast router port within VLAN 1.

```
SSE-G2252(config)#ip igmp snooping vlan 1 mrouter ethernet 1/11
SSE-G2252(config)#
```

show ip igmp snooping mrouter

This command displays information on statically configured and dynamically learned multicast router ports.

Syntax

show ip igmp snooping mrouter [**vlan** *vlan-id*]

vlan-id - VLAN ID (Range: 1-4093)

Default Setting

Displays multicast router ports for all configured VLANs.

Command Mode

Privileged Exec

Command Usage

Multicast router port types displayed include Static or Dynamic.

Example

The following shows the ports in VLAN 1 which are attached to multicast routers.

```
SSE-G2252#show ip igmp snooping mrouter vlan 1
 VLAN M'cast Router Ports Type
 ---- ------------------- -------
    1            Eth 1/11  Static
SSE-G2252#
```

38-3 IGMP Filtering and Throttling

In certain switch applications, the administrator may want to control the multicast services that are available to end users. For example, an IP/TV service based on a specific subscription plan. The IGMP filtering feature fulfills this requirement by restricting access to specified multicast services on a switch port, and IGMP throttling limits the number of simultaneous multicast groups a port can join.

Table 38-4. IGMP Filtering and Throttling Commands

Command	Function	Mode
ip igmp filter (Global Configuration)	Enables IGMP filtering and throttling on the switch	GC
ip igmp profile	Sets a profile number and enters IGMP filter profile configuration mode	GC
permit, deny	Sets a profile access mode to permit or deny	IPC
range	Specifies one or a range of multicast addresses for a profile	IPC
ip igmp filter (Interface Configuration)	Assigns an IGMP filter profile to an interface	IC
ip igmp max-groups	Specifies an IGMP throttling number for an interface	IC
ip igmp max-groups action	Sets the IGMP throttling action for an interface	IC
show ip igmp filter	Displays the IGMP filtering status	PE
show ip igmp profile	Displays IGMP profiles and settings	PE
show ip igmp throttle interface	Displays the IGMP throttling setting for interfaces	PE

ip igmp filter (Global Configuration)

This command globally enables IGMP filtering and throttling on the switch. Use the **no** form to disable the feature.

Syntax

[**no**] **ip igmp filter**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- IGMP filtering enables you to assign a profile to a switch port that specifies multicast groups that are permitted or denied on the port. An IGMP filter profile can contain one or more, or a range of multicast addresses; but only one profile can be assigned to a port. When enabled, IGMP join reports received on the port are checked against the filter profile. If a requested multicast group is permitted, the IGMP join report is forwarded as normal. If a requested multicast group is denied, the IGMP join report is dropped.
- IGMP filtering and throttling only applies to dynamically learned multicast groups, it does not apply to statically configured groups.
- The IGMP filtering feature operates in the same manner when MVR is used to forward multicast traffic.

Example

```
SSE-G2252(config)#ip igmp filter
SSE-G2252(config)#
```

ip igmp profile

This command creates an IGMP filter profile number and enters IGMP profile configuration mode. Use the **no** form to delete a profile number.

Syntax

[**no**] **ip igmp profile** *profile-number*

profile-number - An IGMP filter profile number. (Range: 1-4294967295)

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

A profile defines the multicast groups that a subscriber is permitted or denied to join. The same profile can be applied to many interfaces, but only one profile can be assigned to one interface. Each profile has only one access mode; either permit or deny.

Example

```
SSE-G2252(config)#ip igmp profile 19
SSE-G2252(config-igmp-profile)#
```

permit, deny

This command sets the access mode for an IGMP filter profile. Use the **no** form to delete a profile number.

Syntax

{**permit** | **deny**}

Default Setting

Deny

Command Mode

IGMP Profile Configuration

Command Usage

- Each profile has only one access mode; either permit or deny.
- When the access mode is set to permit, IGMP join reports are processed when a multicast group falls within the controlled range. When the access mode is set to deny, IGMP join reports are only processed when a multicast group is not in the controlled range.

Example

```
SSE-G2252(config)#ip igmp profile 19
SSE-G2252(config-igmp-profile)#permit
SSE-G2252(config-igmp-profile)#
```

range

This command specifies multicast group addresses for a profile. Use the **no** form to delete addresses from a profile.

Syntax

[**no**] **range** *low-ip-address* [*high-ip-address*]

low-ip-address - A valid IP address of a multicast group or start of a group range.

high-ip-address - A valid IP address for the end of a multicast group range.

Default Setting

None

Command Mode

IGMP Profile Configuration

Command Usage

Enter this command multiple times to specify more than one multicast address or address range for a profile.

Example

```
SSE-G2252(config)#ip igmp profile 19
SSE-G2252(config-igmp-profile)#range 239.1.1.1
SSE-G2252(config-igmp-profile)#range 239.2.3.1 239.2.3.100
SSE-G2252(config-igmp-profile)#
```

ip igmp filter (Interface Configuration)

This command assigns an IGMP filtering profile to an interface on the switch. Use the **no** form to remove a profile from an interface.

Syntax

[**no**] **ip igmp filter** *profile-number*

profile-number - An IGMP filter profile number. (Range: 1-4294967295)

Default Setting

None

Command Mode

Interface Configuration

Command Usage

- The IGMP filtering profile must first be created with the ip igmp profile command before being able to assign it to an interface.
- Only one profile can be assigned to an interface.
- A profile can also be assigned to a trunk interface. When ports are configured as trunk members, the trunk uses the filtering profile assigned to the first port member in the trunk.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#ip igmp filter 19
SSE-G2252(config-if)#
```

ip igmp max-groups

This command sets the IGMP throttling number for an interface on the switch. Use the **no** form to restore the default setting.

Syntax

ip igmp max-groups *number*

no ip igmp max-groups

number - The maximum number of multicast groups an interface can join at the same time. (Range: 1-255)

Default Setting

255

Command Mode

Interface Configuration (Ethernet)

Command Usage

- IGMP throttling sets a maximum number of multicast groups that a port can join at the same time. When the maximum number of groups is reached on a port, the switch can take one of two actions; either “deny” or “replace.” If the action is set to deny, any new IGMP join reports will be dropped. If the action is set to replace, the switch randomly removes an existing group and replaces it with the new multicast group.
- IGMP throttling can also be set on a trunk interface. When ports are configured as trunk members, the trunk uses the throttling settings of the first port member in the trunk.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#ip igmp max-groups 10
SSE-G2252(config-if)#
```

ip igmp max-groups action

This command sets the IGMP throttling action for an interface on the switch.

Syntax

ip igmp max-groups action {**replace** | **deny**}

replace - The new multicast group replaces an existing group.

deny - The new multicast group join report is dropped.

Default Setting

Deny

Command Mode

Interface Configuration (Ethernet)

Command Usage

When the maximum number of groups is reached on a port, the switch can take one of two actions; either "deny" or "replace." If the action is set to deny, any new IGMP join reports will be dropped. If the action is set to replace, the switch randomly removes an existing group and replaces it with the new multicast group.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#ip igmp max-groups action replace
SSE-G2252(config-if)#
```

show ip igmp filter

This command displays the global and interface settings for IGMP filtering.

Syntax

show ip igmp filter [**interface** *interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip igmp filter
IGMP filter enabled
SSE-G2252#show ip igmp filter interface ethernet 1/1
Ethernet 1/1 information
---------------------------------
 IGMP Profile 19
  Deny
  range 239.1.1.1 239.1.1.1
  range 239.2.3.1 239.2.3.100
SSE-G2252#
```

show ip igmp profile

This command displays IGMP filtering profiles created on the switch.

Syntax

show ip igmp profile [*profile-number*]

profile-number - An existing IGMP filter profile number.
(Range: 1-4294967295)

Default Setting

None

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip igmp profile
IGMP Profile 19
IGMP Profile 50
SSE-G2252#show ip igmp profile 19
IGMP Profile 19
  Deny
  range 239.1.1.1 239.1.1.1
  range 239.2.3.1 239.2.3.100
SSE-G2252#
```

show ip igmp throttle interface

This command displays the interface settings for IGMP throttling.

Syntax

show ip igmp throttle interface [*interface*]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Default Setting

None

Command Mode

Privileged Exec

Command Usage

Using this command without specifying an interface displays information for all interfaces.

Example

```
SSE-G2252#show ip igmp throttle interface ethernet 1/1
Eth  1/1 Information
  Status : TRUE
  Action : Deny
  Max Multicast Groups : 32
  Current Multicast Groups : 0

SSE-G2252#
```

38-4 Multicast VLAN Registration

This section describes commands used to configure Multicast VLAN Registration (MVR). A single network-wide VLAN can be used to transmit multicast traffic (such as television channels) across a service provider's network. Any multicast traffic entering an MVR VLAN is sent to all subscribers. This can significantly reduce to processing overhead required to dynamically monitor and establish the distribution tree for a normal multicast VLAN. Also note that MVR maintains the user isolation and data security provided by VLAN segregation by passing only multicast traffic into other VLANs to which the subscribers belong.

Table 38-5. Multicast VLAN Registration Commands

Command	Function	Mode
mvr	Globally enables MVR, statically configures MVR group address(es), or specifies the MVR VLAN identifier	GC
mvr immediate-leave	Enables immediate leave capability	IC
mvr type	Configures an interface as an MVR receiver or source port	IC
mvr vlan group	Statically binds a multicast group to a port	IC
show mvr	Shows information about the global MVR configuration settings, interfaces attached to the MVR VLAN, or the multicast groups assigned to the MVR VLAN	PE

mvr

This command enables Multicast VLAN Registration (MVR) globally on the switch, statically configures MVR multicast group IP address(es) using the **group** keyword, or specifies the MVR VLAN identifier using the **vlan** keyword. Use the **no** form of this command without any keywords to globally disable MVR. Use the **no** form with the **group** keyword to remove a specific address or range of addresses. Or use the **no** form with the **vlan** keyword to restore the default MVR VLAN.

Syntax

[**no**] **mvr** [**group** *ip-address* [*count*] | **vlan** *vlan-id*]

group - Defines a multicast service sent to all attached subscribers.

ip-address - IP address for an MVR multicast group.
(Range: 224.0.1.0 - 239.255.255.255)

count - The number of contiguous MVR group addresses. (Range: 1-1024)

vlan - Specifies the VLAN through which MVR multicast data is received. This is also the VLAN to which all source ports must be assigned.

vlan-id - MVR VLAN ID (Range: 1-4093)

Default Setting

MVR is disabled.

No MVR group address is defined.

The default number of contiguous addresses is 0.

MVR VLAN ID is 1.

Command Mode

Global Configuration

Command Usage

- Use the **mvr group** command to statically configure all multicast group addresses that will join the MVR VLAN. Any multicast data associated with an MVR group is sent from all source ports, to all receiver ports that have registered to receive data from that multicast group.
- The IP address range from 224.0.0.0 to 239.255.255.255 is used for multicast streams. MVR group addresses cannot fall within the reserved IP multicast address range of 224.0.0.x.
- Only IGMP version 2 or 3 hosts can issue multicast join or leave messages. If MVR must be configured for an IGMP version 1 host, the multicast groups must be statically assigned using the mvr vlan group command.
- IGMP snooping and MVR share a maximum number of 255 groups. Any multicast streams received in excess of this limitation will be flooded to all ports in the associated VLAN.
- MVR source ports can be configured as members of the MVR VLAN using the switchport allowed vlan command and switchport native vlan command, but MVR receiver ports should not be configured as members of this VLAN.

Example

The following example enables MVR globally, and configures a range of MVR group addresses:

```
SSE-G2252(config)#mvr
SSE-G2252(config)#mvr group 228.1.23.1 10
SSE-G2252(config)#
```

mvr immediate-leave

This command causes the switch to immediately remove an interface from a multicast stream as soon as it receives a leave message for that group. Use the **no** form to restore the default settings.

Syntax

[**no**] **mvr immediate**

Default Setting

Disabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Immediate leave applies only to receiver ports. When enabled, the receiver port is immediately removed from the multicast group identified in the leave message. When immediate leave is disabled, the switch follows the standard rules by sending a group-specific query to the receiver port and waiting for a response to determine if there are any remaining subscribers for that multicast group before removing the port from the group list.
- Using immediate leave can speed up leave latency, but should only be enabled on a port attached to only one multicast subscriber to avoid disrupting services to other group members attached to the same interface.
- Immediate leave does not apply to multicast groups which have been statically assigned to a port with the mvr vlan group command.

Example

The following enables immediate leave on a receiver port.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#mvr immediate
SSE-G2252(config-if)#
```

mvr type

This command configures an interface as an MVR receiver or source port. Use the **no** form to restore the default settings.

Syntax

[**no**] **mvr type** {**receiver** | **source**}

receiver - Configures the interface as a subscriber port that can receive multicast data.

source - Configures the interface as an uplink port that can send and receive multicast data for the configured multicast groups.

Default Setting

The port type is not defined.

Command Mode

Interface Configuration (Ethernet)

Command Usage

- A port which is not configured as an MVR receiver or source port can use IGMP snooping to join or leave multicast groups using the standard rules for multicast filtering.
- Receiver ports can belong to different VLANs, but should not normally be configured as a member of the MVR VLAN. IGMP snooping can also be used to allow a receiver port to dynamically join or leave multicast groups not sourced through the MVR VLAN. Also, note that VLAN membership for MVR receiver ports cannot be set to access mode (see the switchport mode command).
- One or more interfaces may be configured as MVR source ports. A source port is able to both receive and send data for multicast groups which it has joined through the MVR protocol or which have been assigned through the mvr vlan group command.
- Only IGMP version 2 or 3 hosts can issue multicast join or leave messages. If MVR must be configured for an IGMP version 1 host, the multicast groups must be statically assigned using the mvr vlan group command.

Example

The following configures one source port and several receiver ports on the switch.

```
SSE-G2252(config)#interface ethernet 1/5
SSE-G2252(config-if)#mvr type source
SSE-G2252(config-if)#exit
SSE-G2252(config)#interface ethernet 1/6
SSE-G2252(config-if)#mvr type receiver
SSE-G2252(config-if)#exit
```

```
SSE-G2252(config)#interface ethernet 1/7
SSE-G2252(config-if)#mvr type receiver
SSE-G2252(config-if)#
```

mvr vlan group

This command statically binds a multicast group to a port which will receive long-term multicast streams associated with a stable set of hosts. Use the **no** form to restore the default settings.

Syntax

[**no**] **mvr vlan** *vlan-id* **group** *ip-address*

vlan-id - Receiver VLAN to which the specified multicast traffic is flooded. (Range: 1-4093)

group - Defines a multicast service sent to the selected port.

ip-address - Statically configures an interface to receive multicast traffic from the IP address specified for an MVR multicast group. (Range: 224.0.1.0 - 239.255.255.255)

Default Setting

No receiver port is a member of any configured multicast group.

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Multicast groups can be statically assigned to a receiver port using this command.
- The IP address range from 224.0.0.0 to 239.255.255.255 is used for multicast streams. MVR group addresses cannot fall within the reserved IP multicast address range of 224.0.0.x.
- Only IGMP version 2 or 3 hosts can issue multicast join or leave messages. If MVR must be configured for an IGMP version 1 host, the multicast groups must be statically assigned using the **mvr vlan group** command.

Example

The following statically assigns a multicast group to a receiver port:

```
SSE-G2252(config)#interface ethernet 1/7
SSE-G2252(config-if)#mvr type receiver
SSE-G2252(config-if)#mvr vlan 3 group 225.0.0.5
SSE-G2252(config-if)#
```

show mvr

This command shows information about the global MVR configuration settings when entered without any keywords, the interfaces attached to the MVR VLAN using the **interface** keyword, or the multicast groups assigned to the MVR VLAN using the **members** keyword.

Syntax

show mvr [**interface** [*interface*] | **members** [*ip-address*]]

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

ip-address - IP address for an MVR multicast group.
(Range: 224.0.1.0 - 239.255.255.255)

Default Setting

Displays global configuration settings for MVR when no keywords are used.

Command Mode

Privileged Exec

Command Usage

Enter this command without any keywords to display the global settings for MVR. Use the **interface** keyword to display information about interfaces attached to the MVR VLAN. Or use the **members** keyword to display information about multicast groups assigned to the MVR VLAN.

Example

The following shows the global MVR settings:

```
SSE-G2252#show mvr
 MVR Config Status   : Enabled
 MVR Running Status  : Active
 MVR Multicast VLAN  : 1
 MVR Group Address   : 225.0.0.5
 MVR Group Count     : 10
SSE-G2252#
```

Table 38-6. show mvr - Display Description

Field	Description
MVR Config Status	Shows if MVR is globally enabled on the switch.
MVR Running Status	Indicates whether or not all necessary conditions in the MVR environment are satisfied. (Running status is true as long as MVR Status is enabled, and the specified MVR VLAN exists.)
MVR Multicast VLAN	Shows the VLAN used to transport all MVR multicast traffic.
MVR Group Address	A multicast service sent to all attached subscribers
MVR Group Count	The number of contiguous MVR group addresses.

The following displays information about the interfaces attached to the MVR VLAN:

```
SSE-G2252#show mvr interface
 Port         Type         Status          Immediate   Static Group Address
 --------     --------     -------------   ---------   --------------------
 Eth1/ 2      Source       Active/Up
 Eth1/ 3      Source       Inactive/Down
 Eth1/ 1      Receiver     Active/Up       Disabled    225.0.0.1(VLAN1)
                                                       225.0.0.9(VLAN3)
 Eth1/ 4      Receiver     Active/Down     Disabled

SSE-G2252#
```

Table 38-7. show mvr interface - Display Description

Field	Description
Port	Shows interfaces attached to the MVR.
Type	Shows the MVR port type.
Status	Shows the MVR status and interface status. MVR status for source ports is “ACTIVE” if MVR is globally enabled on the switch. MVR status for receiver ports is “ACTIVE” only if there are subscribers receiving multicast traffic from one of the MVR groups, or a multicast group has been statically assigned to an interface.
Immediate Leave	Shows if immediate leave is enabled or disabled.
Static Group Address	Shows any static MVR group assigned to an interface, and the receiver VLAN.

The following shows information about the interfaces associated with multicast groups assigned to the MVR VLAN:

```
SSE-G2252#show mvr members
 MVR Forwarding Entry Count:1
 Group Address     Source Address    VLAN  Forwarding Port
 -------------     --------------    ----  --------------
 225.0.0.9         *                 2     Eth1/ 1(VLAN3)    Eth1/ 2(VLAN2)
SSE-G2252#
```

Table 38-8. show mvr members - Display Description

Field	Description
MVR Forwarding Entry Count	The number of multicast services currently being forwarded from the MVR VLAN.
Group Address	Multicast groups assigned to the MVR VLAN.
Source Address	Indicates the source address of the multicast service, or displays an asterisk if the group address has been statically assigned.
VLAN	Indicates the MVR VLAN receiving the multicast service.
Forwarding Port	Shows the interfaces with subscribers for multicast services provided through the MVR VLAN. Also shows the VLAN through which the service is received. Note that this may be different from the MVR VLAN if the group address has been statically assigned.

Chapter 39
LLDP Commands

Link Layer Discovery Protocol (LLDP) is used to discover basic information about neighboring devices on the local broadcast domain. LLDP is a Layer 2 protocol that uses periodic broadcasts to advertise information about the sending device. Advertised information is represented in Type Length Value (TLV) format according to the IEEE 802.1ab standard, and can include details such as device identification, capabilities and configuration settings. LLDP also defines how to store and maintain information gathered about the neighboring network nodes it discovers.

Link Layer Discovery Protocol - Media Endpoint Discovery (LLDP-MED) is an extension of LLDP intended for managing endpoint devices such as Voice over IP phones and network switches. The LLDP-MED TLVs advertise information such as network policy, power, inventory, and device location details. LLDP and LLDP-MED information can be used by SNMP applications to simplify troubleshooting, enhance network management, and maintain an accurate network topology.

Table 39-1. LLDP Commands

Command	Function	Mode
lldp	Enables LLDP globally on the switch	GC
lldp holdtime-multiplier	Configures the time-to-live (TTL) value sent in LLDP advertisements	GC
lldp med-fast-start-count	Configures how many medFastStart packets are transmitted	GC
lldp notification-interval	Configures the allowed interval for sending SNMP notifications about LLDP changes	GC
lldp refresh-interval	Configures the periodic transmit interval for LLDP advertisements	GC
lldp reinit-delay	Configures the delay before attempting to re-initialize after LLDP ports are disabled or the link goes down	GC
lldp tx-delay	Configures a delay between the successive transmission of advertisements initiated by a change in local LLDP MIB variables	GC
lldp admin-status	Enables LLDP transmit, receive, or transmit and receive mode on the specified port	IC
lldp basic-tlv management-ip-address	Configures an LLDP-enabled port to advertise the management address for this device	IC
lldp basic-tlv port-description	Configures an LLDP-enabled port to advertise its port description	IC
lldp basic-tlv system-capabilities	Configures an LLDP-enabled port to advertise its system capabilities	IC
lldp basic-tlv system-description	Configures an LLDP-enabled port to advertise the system description	IC
lldp basic-tlv system-name	Configures an LLDP-enabled port to advertise its system name	IC

Table 39-1. LLDP Commands (Continued)

Command	Function	Mode
lldp dot1-tlv proto-ident[a]	Configures an LLDP-enabled port to advertise the supported protocols	IC
lldp dot1-tlv proto-vid[a]	Configures an LLDP-enabled port to advertise port related VLAN information	IC
lldp dot1-tlv pvid[a]	Configures an LLDP-enabled port to advertise its default VLAN ID	IC
lldp dot1-tlv vlan-name[a]	Configures an LLDP-enabled port to advertise its VLAN name	IC
lldp dot3-tlv link-agg	Configures an LLDP-enabled port to advertise its link aggregation capabilities	IC
lldp dot3-tlv mac-phy	Configures an LLDP-enabled port to advertise its MAC and physical layer specifications	IC
lldp dot3-tlv max-frame	Configures an LLDP-enabled port to advertise its maximum frame size	IC
lldp dot3-tlv poe	Configures an LLDP-enabled port to advertise its Power-over-Ethernet capabilities	IC
lldp med-location civic-addr	Configures an LLDP-MED-enabled port to advertise its location identification details	IC
lldp med-notification	Enables the transmission of SNMP trap notifications about LLDP-MED changes	IC
lldp med-tlv ext-poe	Configures an LLDP-MED-enabled port to advertise its extended Power over Ethernet configuration and usage information	IC
lldp med-tlv inventory	Configures an LLDP-MED-enabled port to advertise its inventory identification details	IC
lldp med-tlv location	Configures an LLDP-MED-enabled port to advertise its location identification details	IC
lldp med-tlv med-cap	Configures an LLDP-MED-enabled port to advertise its Media Endpoint Device capabilities	IC
lldp med-tlv network-policy	Configures an LLDP-MED-enabled port to advertise its network policy configuration	IC
lldp notification	Enables the transmission of SNMP trap notifications about LLDP changes	IC
show lldp config	Shows LLDP configuration settings for all ports	PE
show lldp info local-device	Shows LLDP global and interface-specific configuration settings for this device	PE
show lldp info remote-device	Shows LLDP global and interface-specific configuration settings for remote devices	PE
show lldp info statistics	Shows statistical counters for all LLDP-enabled interfaces	PE

a. Vendor-specific options may or may not be advertised by neighboring devices.

lldp

This command enables LLDP globally on the switch. Use the **no** form to disable LLDP.

Syntax

[**no**] **lldp**

Default Setting

Enabled

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#lldp
SSE-G2252(config)#
```

lldp holdtime-multiplier

This command configures the time-to-live (TTL) value sent in LLDP advertisements. Use the **no** form to restore the default setting.

Syntax

lldp holdtime-multiplier *value*

no lldp holdtime-multiplier

value - Calculates the TTL in seconds based on the following rule: minimum of ((Transmission Interval * Holdtime Multiplier), or 65536) (Range: 2 - 10)

Default Setting

Holdtime multiplier: 4

TTL: 4*30 = 120 seconds

Command Mode

Global Configuration

Command Usage

The time-to-live tells the receiving LLDP agent how long to retain all information pertaining to the sending LLDP agent if it does not transmit updates in a timely manner.

Example

```
SSE-G2252(config)#lldp holdtime-multiplier 10
SSE-G2252(config)#
```

lldp med-fast-start-count

This command specifies the amount of MED Fast Start LLDPDUs to transmit during the activation process of the LLDP-MED Fast Start mechanism.

Syntax

lldp med-fast-start-count *packets*

seconds - Amount of packets. (Range: 1-10 packets; Default: 4 packets)

Default Setting

4 packets

Command Mode

Global Configuration

Command Usage

This parameter is part of the timer which ensures that the LLDP-MED Fast Start mechanism is active for the port. LLDP-MED Fast Start is critical to the timely startup of LLDP, and therefore integral to the rapid availability of Emergency Call Service.

Example

```
SSE-G2252(config)#lldp med-fast-start-count 6
SSE-G2252(config)#
```

lldp notification-interval

This command configures the allowed interval for sending SNMP notifications about LLDP MIB changes. Use the **no** form to restore the default setting.

Syntax

lldp notification-interval *seconds*

no lldp notification-interval

seconds - Specifies the periodic interval at which SNMP notifications are sent. (Range: 5 - 3600 seconds)

Default Setting

5 seconds

Command Mode

Global Configuration

Command Usage

- This parameter only applies to SNMP applications which use data stored in the LLDP MIB for network monitoring or management.
- Information about changes in LLDP neighbors that occur between SNMP notifications is not transmitted. Only state changes that exist at the time of a notification are included in the transmission. An SNMP agent should therefore periodically check the value of lldpStatsRemTableLastChangeTime to detect any lldpRemTablesChange notification-events missed due to throttling or transmission loss.

Example

```
SSE-G2252(config)#lldp notification-interval 30
SSE-G2252(config)#
```

lldp refresh-interval

This command configures the periodic transmit interval for LLDP advertisements. Use the **no** form to restore the default setting.

Syntax

lldp refresh-interval *seconds*

no lldp refresh-delay

seconds - Specifies the periodic interval at which LLDP advertisements are sent. (Range: 5 - 32768 seconds)

Default Setting

30 seconds

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#lldp refresh-interval 60
SSE-G2252(config)#
```

lldp reinit-delay

This command configures the delay before attempting to re-initialize after LLDP ports are disabled or the link goes down. Use the **no** form to restore the default setting.

Syntax

lldp reinit-delay *seconds*

no lldp reinit-delay

seconds - Specifies the delay before attempting to re-initialize LLDP. (Range: 1 - 10 seconds)

Default Setting

2 seconds

Command Mode

Global Configuration

Command Usage

When LLDP is re-initialized on a port, all information in the remote systems LLDP MIB associated with this port is deleted.

Example

```
SSE-G2252(config)#lldp reinit-delay 10
SSE-G2252(config)#
```

lldp tx-delay

This command configures a delay between the successive transmission of advertisements initiated by a change in local LLDP MIB variables. Use the **no** form to restore the default setting.

Syntax

lldp tx-delay *seconds*

no lldp tx-delay

seconds - Specifies the transmit delay. (Range: 1 - 8192 seconds)

Default Setting

2 seconds

Command Mode

Global Configuration

Command Usage

- The transmit delay is used to prevent a series of successive LLDP transmissions during a short period of rapid changes in local LLDP MIB objects, and to increase the probability that multiple, rather than single changes, are reported in each transmission.
- This attribute must comply with the following rule:(4 * tx-delay) ≤ refresh-interval

Example

```
SSE-G2252(config)#lldp tx-delay 10
SSE-G2252(config)#
```

lldp admin-status

This command enables LLDP transmit, receive, or transmit and receive mode on the specified port. Use the **no** form to disable this feature.

Syntax

lldp admin-status {**rx-only** | **tx-only** | **tx-rx**}

no lldp admin-status

rx-only - Only receive LLDP PDUs.

tx-only - Only transmit LLDP PDUs.

tx-rx - Both transmit and receive LLDP Protocol Data Units (PDUs).

Default Setting

tx-rx

Command Mode

Interface Configuration (Ethernet, Port Channel)

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp admin-status rx-only
SSE-G2252(config-if)#
```

lldp basic-tlv management-ip-address

This command configures an LLDP-enabled port to advertise the management address for this device. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp basic-tlv management-ip-address**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- The management address protocol packet includes the IPv4 address of the switch. If no management address is available, the address should be the MAC address for the CPU or for the port sending this advertisement.
- The management address TLV may also include information about the specific interface associated with this address, and an object identifier indicating the type of hardware component or protocol entity associated with this address. The interface number and OID are included to assist SNMP applications to perform network discovery by indicating enterprise specific or other starting points for the search, such as the Interface or Entity MIB.
- Since there are typically a number of different addresses associated with a Layer 3 device, an individual LLDP PDU may contain more than one management address TLV.
- Every management address TLV that reports an address that is accessible on a port and protocol VLAN through the particular port should be accompanied by a port and protocol VLAN TLV that indicates the VLAN identifier (VID) associated with the management address reported by this TLV.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp basic-tlv management-ip-address
SSE-G2252(config-if)#
```

lldp basic-tlv port-description

This command configures an LLDP-enabled port to advertise its port description. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp basic-tlv port-description**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

The port description is taken from the ifDescr object in RFC 2863, which includes information about the manufacturer, the product name, and the version of the interface hardware/software.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp basic-tlv port-description
SSE-G2252(config-if)#
```

lldp basic-tlv system-capabilities

This command configures an LLDP-enabled port to advertise its system capabilities. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp basic-tlv system-capabilities**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

The system capabilities identifies the primary function(s) of the system and whether or not these primary functions are enabled. The information advertised by this TLV is described in IEEE 802.1AB.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp basic-tlv system-capabilities
SSE-G2252(config-if)#
```

lldp basic-tlv system-description

This command configures an LLDP-enabled port to advertise the system description. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp basic-tlv system-description**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

The system description is taken from the sysDescr object in RFC 3418, which includes the full name and version identification of the system's hardware type, software operating system, and networking software.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp basic-tlv system-description
SSE-G2252(config-if)#
```

lldp basic-tlv system-name

This command configures an LLDP-enabled port to advertise the system name. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp basic-tlv system-name**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

The system name is taken from the sysName object in RFC 3418, which contains the system's administratively assigned name, and is in turn based on the hostname command.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp basic-tlv system-name
SSE-G2252(config-if)#
```

lldp dot1-tlv proto-ident

This command configures an LLDP-enabled port to advertise the supported protocols. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp dot1-tlv proto-ident**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises the protocols that are accessible through this interface.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#no lldp dot1-tlv proto-ident
SSE-G2252(config-if)#
```

lldp dot1-tlv proto-vid

This command configures an LLDP-enabled port to advertise port-based protocol VLAN information. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp dot1-tlv proto-vid**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises the port-based protocol VLANs configured on this interface (see Section 35-7: "Configuring Protocol-based VLANs" on page 35-26).

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#no lldp dot1-tlv proto-vid
SSE-G2252(config-if)#
```

lldp dot1-tlv pvid

This command configures an LLDP-enabled port to advertise its default VLAN ID. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp dot1-tlv pvid**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

The port's default VLAN identifier (PVID) indicates the VLAN with which untagged or priority-tagged frames are associated (see the switchport native vlan command).

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#no lldp dot1-tlv pvid
SSE-G2252(config-if)#
```

lldp dot1-tlv vlan-name

This command configures an LLDP-enabled port to advertise its VLAN name. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp dot1-tlv vlan-name**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises the name of all VLANs to which this interface has been assigned. See "switchport allowed vlan" on page 35-13 and "protocol-vlan protocol-group (Configuring Interfaces)" on page 35-28.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#no lldp dot1-tlv vlan-name
SSE-G2252(config-if)#
```

lldp dot3-tlv link-agg

This command configures an LLDP-enabled port to advertise link aggregation capabilities. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp dot3-tlv link-agg**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises link aggregation capabilities, aggregation status of the link, and the 802.3 aggregated port identifier if this interface is currently a link aggregation member.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#no lldp dot3-tlv link-agg
SSE-G2252(config-if)#
```

lldp dot3-tlv mac-phy

This command configures an LLDP-enabled port to advertise its MAC and physical layer capabilities. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp dot3-tlv mac-phy**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises MAC/PHY configuration/status which includes information about auto-negotiation support/capabilities, and operational Multistation Access Unit (MAU) type.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#no lldp dot3-tlv mac-phy
SSE-G2252(config-if)#
```

lldp dot3-tlv max-frame

This command configures an LLDP-enabled port to advertise its maximum frame size. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp dot3-tlv max-frame**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

Refer to Section 21-3: "Frame Size" on page 21-12 for information on configuring the maximum frame size for this switch.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp dot3-tlv max-frame
SSE-G2252(config-if)#
```

lldp dot3-tlv poe

This command configures an LLDP-enabled port to advertise its Power-over-Ethernet (PoE) capabilities. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp dot3-tlv poe**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises Power-over-Ethernet capabilities, including whether or not PoE is supported, currently enabled, if the port pins through which power is delivered can be controlled, the port pins selected to deliver power, and the power class.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp dot3-tlv poe
SSE-G2252(config-if)#
```

lldp med-location civic-addr

This command configures an LLDP-MED-enabled port to advertise its location identification details. Use the **no** form to restore the default settings.

Syntax

lldp med-location civic-addr [[**country** *country-code*] | [**what** *device-type*] | [*ca-type ca-value*]]

no lldp med-location civic-addr [[**country**] | [**what**] | [*ca-type*]]

country-code – The two-letter ISO 3166 country code in capital ASCII letters. (Example: DK, DE or US)

device-type – The type of device to which the location applies.

0 – Location of DHCP server.

1 – Location of network element closest to client.

2 – Location of client.

ca-type – A one-octet descriptor of the data civic address value. (Range: 0-255)

ca-value – Description of a location. (Range: 1-32 characters)

Default Setting

Not advertised

No description

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- Use this command without any keywords to advertise location identification details.
- Use the *ca-type* to advertise the physical location of the device, that is the city, street number, building and room information. The address location is specified as a type and value pair, with the civic address (CA) type being defined in RFC 4776. The following table describes some of the CA type numbers and provides examples.

Table 39-2. LLDP MED Location CA Types

CA Type	Description	CA Value Example
1	National subdivisions (state, canton, province)	California
2	County, parish	Orange
3	City, township	Irvine
4	City division, borough, city district	West Irvine

Table 39-2. LLDP MED Location CA Types (Continued)

CA Type	Description	CA Value Example
5	Neighborhood, block	Riverside
6	Group of streets below the neighborhood level	Exchange
18	Street suffix or type	Avenue
19	House number	320
20	House number suffix	A
21	Landmark or vanity address	Tech Center
26	Unit (apartment, suite)	Apt 519
27	Floor	5
28	Room	509B

Any number of CA type and value pairs can be specified for the civic address location, as long as the total does not exceed 250 characters.

- For the location options defined for *device-type*, normally option **2** is used to specify the location of the client device. In situations where the client device location is not known, **0** and **1** can be used, providing the client device is physically close to the DHCP server or network element.

Example

The following example enables advertising location identification details.

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp med-location civic-addr
SSE-G2252(config-if)#lldp med-location civic-addr 1 California
SSE-G2252(config-if)#lldp med-location civic-addr 2 Orange
SSE-G2252(config-if)#lldp med-location civic-addr 3 Irvine
SSE-G2252(config-if)#lldp med-location civic-addr 4 West Irvine
SSE-G2252(config-if)#lldp med-location civic-addr 6 Exchange
SSE-G2252(config-if)#lldp med-location civic-addr 18 Avenue
SSE-G2252(config-if)#lldp med-location civic-addr 19 320
SSE-G2252(config-if)#lldp med-location civic-addr 27 5
SSE-G2252(config-if)#lldp med-location civic-addr 28 509B
SSE-G2252(config-if)#lldp med-location civic-addr country US
SSE-G2252(config-if)#lldp med-location civic-addr what 2
SSE-G2252(config-if)#
```

lldp med-notification

This command enables the transmission of SNMP trap notifications about LLDP-MED changes. Use the **no** form to disable LLDP-MED notifications.

Syntax

[**no**] **lldp med-notification**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- This option sends out SNMP trap notifications to designated target stations at the interval specified by the lldp notification-interval command. Trap notifications include information about state changes in the LLDP MIB (IEEE 802.1AB), the LLDP-MED MIB (ANSI/TIA 1057), or organization-specific LLDP-EXT-DOT1 and LLDP-EXT-DOT3 MIBs.
- SNMP trap destinations are defined using the snmp-server host command.
- Information about additional changes in LLDP neighbors that occur between SNMP notifications is not transmitted. Only state changes that exist at the time of a trap notification are included in the transmission. An SNMP agent should therefore periodically check the value of lldpStatsRemTableLastChangeTime to detect any lldpRemTablesChange notification-events missed due to throttling or transmission loss.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp med-notification
SSE-G2252(config-if)#
```

lldp med-tlv ext-poe

This command configures an LLDP-MED-enabled port to advertise and accept Extended Power-over-Ethernet configuration and usage information. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp med-tlv ext-poe**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises extended Power-over-Ethernet capability details, such as power availability from the switch, and power state of the switch, including whether the switch is operating from primary or backup power (the Endpoint Device could use this information to decide to enter power conservation mode). Note that this device does not support PoE capabilities.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#no lldp med-tlv ext-poe
SSE-G2252(config-if)#
```

lldp med-tlv inventory

This command configures an LLDP-MED-enabled port to advertise its inventory identification details. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp med-tlv inventory**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises device details useful for inventory management, such as manufacturer, model, software version and other pertinent information.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#no lldp med-tlv inventory
SSE-G2252(config-if)#
```

lldp med-tlv location

This command configures an LLDP-MED-enabled port to advertise its location identification details. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp med-tlv location**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises location identification details.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp med-tlv location
SSE-G2252(config-if)#
```

lldp med-tlv med-cap

This command configures an LLDP-MED-enabled port to advertise its Media Endpoint Device capabilities. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp med-tlv med-cap**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises LLDP-MED TLV capabilities, allowing Media Endpoint and Connectivity Devices to efficiently discover which LLDP-MED related TLVs are supported on the switch.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp med-tlv med-cap
SSE-G2252(config-if)#
```

lldp med-tlv network-policy

This command configures an LLDP-MED-enabled port to advertise its network policy configuration. Use the **no** form to disable this feature.

Syntax

[**no**] **lldp med-tlv network-policy**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

This option advertises network policy configuration information, aiding in the discovery and diagnosis of VLAN configuration mismatches on a port. Improper network policy configurations frequently result in voice quality degradation or complete service disruption.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp med-tlv network-policy
SSE-G2252(config-if)#
```

lldp notification

This command enables the transmission of SNMP trap notifications about LLDP changes. Use the **no** form to disable LLDP notifications.

Syntax

[**no**] **lldp notification**

Default Setting

Enabled

Command Mode

Interface Configuration (Ethernet, Port Channel)

Command Usage

- This option sends out SNMP trap notifications to designated target stations at the interval specified by the lldp notification-interval command. Trap notifications include information about state changes in the LLDP MIB (IEEE 802.1AB), or organization-specific LLDP-EXT-DOT1 and LLDP-EXT-DOT3 MIBs.
- SNMP trap destinations are defined using the snmp-server host command.
- Information about additional changes in LLDP neighbors that occur between SNMP notifications is not transmitted. Only state changes that exist at the time of a trap notification are included in the transmission. An SNMP agent should therefore periodically check the value of lldpStatsRemTableLastChangeTime to detect any lldpRemTablesChange notification-events missed due to throttling or transmission loss.

Example

```
SSE-G2252(config)#interface ethernet 1/1
SSE-G2252(config-if)#lldp notification
SSE-G2252(config-if)#
```

show lldp config

This command shows LLDP configuration settings for all ports.

Syntax

show lldp config [**detail** *interface*]

detail - Shows configuration summary.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show lldp config

LLDP Global Configuation

 LLDP Enabled                : Yes
 LLDP Transmit interval      : 30 sec.
 LLDP Hold Time Multiplier   : 4
 LLDP Delay Interval         : 2 sec.
```

```
 LLDP Re-initialization Delay : 2 sec.
 LLDP Notification Interval   : 5 sec.
 LLDP MED Fast Start Count    : 4

LLDP Port Configuration
 Port     Admin Status Notification Enabled
 -------- ------------ --------------------
 Eth 1/1  Tx-Rx        True
 Eth 1/2  Tx-Rx        True
 Eth 1/3  Tx-Rx        True
 Eth 1/4  Tx-Rx        True
 Eth 1/5  Tx-Rx        True
.
.
.
SSE-G2252#show lldp config detail ethernet 1/1

LLDP Port Configuration Detail

 Port : Eth 1/1
 Admin Status : Tx-Rx
 Notification Enabled : True
 Basic TLVs Advertised:
   port-description
   system-name
   system-description
   system-capabilities
   management-ip-address
 802.1 specific TLVs Advertised:
  *port-vid
  *vlan-name
  *proto-vlan
  *proto-ident
 802.3 specific TLVs Advertised:
  *mac-phy
  *poe
  *link-agg
  *max-frame
 MED Configuration:
 MED Notification Status : Enabled
 MED Enabled TLVs Advertised:
  *med-cap
  *network-policy
  *location
  *ext-poe
  *inventory
 MED Location Identification:
  Location Data Format : Civic Address LCI
  Civic Address Status : Enabled
  Country Name         : US
  What                 : 2
  CA-Type              : 1
  CA-Value             : Alabama
  CA-Type              : 2
  CA-Value             : Tuscaloosa

SSE-G2252#
```

show lldp info local-device

This command shows LLDP global and interface-specific configuration settings for this device.

Syntax

show lldp info local-device [**detail** *interface*]

detail - Shows configuration summary.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Example

```
SSE-G2252P#show lldp info local-device

 LLDP Local System Information
  Chassis Type : MAC Address
  Chassis ID   : 00-01-02-03-04-05
  System Name  :
  System Description          : SSE-G2252P Managed GE POE Switch
  System Capabilities Support : Bridge
  System Capabilities Enabled : Bridge
  Management Address : 192.168.0.101 (IPv4)

 LLDP Port Information
  Port    PortID Type      PortID            Port Description
 -------- ---------------- -----------------
--------------------------------
 Eth 1/1  MAC Address      00-1A-7E-AC-2B-13 Ethernet Port on unit 1, port
1
 Eth 1/2  MAC Address      00-1A-7E-AC-2B-14 Ethernet Port on unit 1, port
2
 Eth 1/3  MAC Address      00-1A-7E-AC-2B-15 Ethernet Port on unit 1, port
3
 Eth 1/4  MAC Address      00-1A-7E-AC-2B-16 Ethernet Port on unit 1, port
4
.
.
.
SSE-G2252P#show lldp info local-device detail ethernet 1/1

LLDP Port Information Detail

 Port             : Eth 1/1
 Port Type        : MAC Address
```

```
 Port ID          : 00-1A-7E-AC-2B-13
 Port Description : Ethernet Port on unit 1, port 1
 MED Capability   : LLDP-MED Capabilities
                    Network Policy
                    Location Identification
                    Extended Power via MDI - PSE
                    Extended Power via MDI - PD
                    Inventory

SSE-G2252P#
```

show lldp info remote-device

This command shows LLDP global and interface-specific configuration settings for remote devices attached to an LLDP-enabled port.

Syntax

show lldp info remote-device [**detail** *interface*]

detail - Shows configuration summary.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Example

Note that an IP phone or other end-node device which advertises LLDP-MED capabilities must be connected to the switch for information to be displayed in the “Device Class” field.

```
SSE-G2252#show lldp info remote-device

 LLDP Remote Devices Information

  Interface Chassis ID        Port ID           System Name
  --------- ----------------- ----------------- --------------------
  Eth 1/1   00-1A-7E-AC-2B-12 00-1A-7E-AC-2B-13

SSE-G2252#show lldp info remote-device detail ethernet 1/1
------------------------------------------------------------------
  Local Port Name    : Eth 1/1
  Chassis Type       : MAC Address
  Chassis ID         : 00-1A-7E-AC-2B-12
  Port ID Type       : MAC Address
  Port ID            : 00-1A-7E-AC-2B-13
```

```
  System Name        :
  System Description : SSE-G2252 Managed GE Switch
  Port Description   : Ethernet Port on unit 1, port 1
  SystemCapSupported : Bridge
  SystemCapEnabled   : Bridge
  Remote Management Address :
    192.168.1.20 (IPv4)
  Remote Port VID : 1
  Remote VLAN Name :
    VLAN-1 : DefaultVlan
  Remote Protocol Identity (Hex) :
    88-CC
  Remote MAC/PHY configuration status :
    Remote port auto-neg supported : Yes
    Remote port auto-neg enabled : Yes
    Remote port auto-neg advertised cap (Hex) : 0000
    Remote port MAU type : 6
  Remote Power via MDI :
    Remote power class : PSE
    Remote power MDI supported : Yes
    Remote power mdi enabled : Yes
    Remote power pair controllable : No
    Remote power pairs : Spare
    Remote power classification : Class1
  Remote Link Aggregation :
    Remote link aggregation capable : Yes
    Remote link aggregation enable : No
  Remote link aggregation port id : 0
  Remote Max Frame Size : 1518
  LLDP-MED Capability :
    Device Class                  : Type Not Defined

SSE-G2252#
```

show lldp info statistics

This command shows statistics based on traffic received through all attached LLDP-enabled interfaces.

Syntax

show lldp info statistics [**detail** *interface*]

detail - Shows configuration summary.

interface

ethernet *unit*/*port*

unit - Unit identifier. (Range: 1)

port - Port number. (Range: 1-52)

port-channel *channel-id* (Range: 1-12)

Command Mode

Privileged Exec

Example

```
switch#show lldp info statistics

 LLDP Device Statistics

  Neighbor Entries List Last Updated : 2450279 seconds
  New Neighbor Entries Count         : 1
  Neighbor Entries Deleted Count     : 0
  Neighbor Entries Dropped Count     : 0
  Neighbor Entries Ageout Count      : 0

  Port     NumFramesRecvd NumFramesSent NumFramesDiscarded
  -------- -------------- ------------ ------------------
  Eth 1/1              0          870                  0
  Eth 1/2            866          867                  0
  Eth 1/3            867          868                  0
  Eth 1/4              0          869                  0
  Eth 1/5            849          862                  0
.
.
.
switch#show lldp info statistics detail ethernet 1/1

 LLDP Port Statistics Detail

  PortName          : Eth 1/1
  Frames Discarded  : 0
  Frames Invalid    : 0
  Frames Received   : 12
  Frames Sent       : 13
  TLVs Unrecognized : 0
  TLVs Discarded    : 0
  Neighbor Ageouts  : 0

switch#
```

Notes

Chapter 40
Domain Name Service Commands

These commands are used to configure Domain Naming System (DNS) services. Entries can be manually configured in the DNS domain name to IP address mapping table, default domain names configured, or one or more name servers specified to use for domain name to address translation.

Note that domain name services will not be enabled until at least one name server is specified with the **ip name-server** command and domain lookup is enabled with the **ip domain-lookup** command.

Table 40-1. Address Table Commands

Command	Function	Mode
ip domain-list	Defines a list of default domain names for incomplete host names	GC
ip domain-lookup	Enables DNS-based host name-to-address translation	GC
ip domain-name	Defines a default domain name for incomplete host names	GC
ip host	Creates a static IPv4 host name-to-address mapping	GC
ip name-server	Specifies the address of one or more name servers to use for host name-to-address translation	GC
ipv6 host	Creates a static IPv6 host name-to-address mapping	GC
clear dns cache	Clears all entries from the DNS cache	PE
clear host	Deletes entries from the host name-to-address table	PE
show dns	Displays the configuration for DNS services	PE
show dns cache	Displays entries in the DNS cache	PE
show hosts	Displays the host name-to-address mapping table	PE

ip domain-list

This command defines a list of domain names that can be appended to incomplete host names (i.e., host names passed from a client that are not formatted with dotted notation). Use the **no** form to remove a name from this list.

Syntax

[**no**] **ip domain-list** *name*

name - Name of the host. Do not include the initial dot that separates the host name from the domain name.
(Range: 1-68 characters)

Default Setting

None

Command Mode

Global Configuration

Command Usage

- Domain names are added to the end of the list one at a time.
- When an incomplete host name is received by the DNS service on this switch, it will work through the domain list, appending each domain name in the list to the host name, and checking with the specified name servers for a match.
- If there is no domain list, the domain name specified with the ip domain-name command is used. If there is a domain list, the default domain name is not used.

Example

This example adds two domain names to the current list and then displays the list.

```
SSE-G2252(config)#ip domain-list sample.com.jp
SSE-G2252(config)#ip domain-list sample.com.uk
SSE-G2252(config)#end
SSE-G2252#show dns
Domain Lookup Status:
    DNS disabled
Default Domain Name:
    sample.com
Domain Name List:
    sample.com.jp
    sample.com.uk
Name Server List:
SSE-G2252#
```

Related Commands

"ip domain-name" on page 40-4

ip domain-lookup

This command enables DNS host name-to-address translation. Use the **no** form to disable DNS.

Syntax

[**no**] **ip domain-lookup**

Default Setting

Disabled

Command Mode

Global Configuration

Command Usage

- At least one name server must be specified before DNS can be enabled.
- If all name servers are deleted, DNS will automatically be disabled.

Example

This example enables DNS and then displays the configuration.

```
SSE-G2252(config)#ip domain-lookup
SSE-G2252(config)#end
SSE-G2252#show dns
Domain Lookup Status:
    DNS enabled
Default Domain Name:
    sample.com
Domain Name List:
    sample.com.jp
    sample.com.uk
Name Server List:
    192.168.1.55
    10.1.0.55
SSE-G2252#
```

Related Commands

"ip domain-name" on page 40-4

"ip name-server" on page 40-6

ip domain-name

This command defines the default domain name appended to incomplete host names (i.e., host names passed from a client that are not formatted with dotted notation). Use the **no** form to remove the current domain name.

Syntax

ip domain-name *name*

no ip domain-name

name - Name of the host. Do not include the initial dot that separates the host name from the domain name.
(Range: 1-127 characters)

Default Setting

None

Command Mode

Global Configuration

Example

```
SSE-G2252(config)#ip domain-name sample.com
SSE-G2252(config)#end
SSE-G2252#show dns
Domain Lookup Status:
    DNS Disabled
Default Domain Name:
    sample.com
Domain Name List:
Name Server List:
SSE-G2252#
```

Related Commands

"ip domain-list" on page 40-2

"ip name-server" on page 40-6

"ip domain-lookup" on page 40-3

ip host

This command creates a static entry in the DNS table that maps a host name to an IPv4 address. Use the **no** form to remove an entry.

Syntax

[**no**] **ip host** *name address*

name - Name of an IPv4 host. (Range: 1-100 characters)

address - Corresponding IPv4 address.

Default Setting

No static entries

Command Mode

Global Configuration

Command Usage

Use the **no ip host** command to clear static entries, or the clear host command to clear dynamic entries.

Example

This example maps an IPv4 address to a host name.

```
SSE-G2252(config)#ip host rd5 192.168.1.55
SSE-G2252(config)#end
SSE-G2252#show hosts
No.  Flag Type    IP Address            TTL   Domain
---- ---- ------- --------------------  -----
------------------------------
   0    2 Address 192.168.1.55                rd5
SSE-G2252#
```

ip name-server

This command specifies the address of one or more domain name servers to use for name-to-address resolution. Use the **no** form to remove a name server from this list.

Syntax

[**no**] **ip name-server** *server-address1* [*server-address2* … *server-address6*]

server-address1 - IP address of domain-name server.

server-address2 … *server-address6* - IP address of additional domain-name servers.

Default Setting

None

Command Mode

Global Configuration

Command Usage

The listed name servers are queried in the specified sequence until a response is received, or the end of the list is reached with no response.

Example

This example adds two domain-name servers to the list and then displays the list.

```
SSE-G2252(config)#ip name-server 192.168.1.55 10.1.0.55
SSE-G2252(config)#end
SSE-G2252#show dns
Domain Lookup Status:
    DNS disabled
Default Domain Name:
    sample.com
Domain Name List:
    sample.com.jp
    sample.com.uk
Name Server List:
    192.168.1.55
    10.1.0.55
SSE-G2252#
```

Related Commands

"ip domain-name" on page 40-4

"ip domain-lookup" on page 40-3

ipv6 host

This command creates a static entry in the DNS table that maps a host name to an IPv6 address. Use the **no** form to remove an entry.

Syntax

[**no**] **ipv6 host** *name ipv6-address*

name - Name of an IPv6 host. (Range: 1-100 characters)

ipv6-address - Corresponding IPv6 address. This address must be entered according to RFC 2373 “IPv6 Addressing Architecture,” using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.

Default Setting

No static entries

Command Mode

Global Configuration

Example

This example maps an IPv6 address to a host name.

```
SSE-G2252(config)#ipv6 host rd6 2001:0db8:1::12
SSE-G2252(config)#end
SSE-G2252#show hosts
No.  Flag Type    IP Address            TTL   Domain
---- ---- ------- --------------------  -----
------------------------------
   0    2 Address 192.168.1.55                rd5
   1    2 Address 2001:DB8:1::12              rd6
SSE-G2252#
```

clear dns cache

This command clears all entries in the DNS cache.

Command Mode

Privileged Exec

Example

```
SSE-G2252#clear dns cache
SSE-G2252#show dns cache
No.     Flag    Type    IP Address      TTL     Domain
------- ------- ------- --------------- ------- --------
SSE-G2252#
```

clear host

This command deletes dynamic entries from the DNS table.

Syntax

clear host {*name* | *}

name - Name of the host. (Range: 1-100 characters)

* - Removes all entries.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

Use the **clear host** command to clear dynamic entries, or the no ip host command to clear static entries.

Example

This example clears all dynamic entries from the DNS table.

```
SSE-G2252(config)#clear host *
SSE-G2252(config)#
```

show dns

This command displays the configuration of the DNS service.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show dns
Domain Lookup Status:
    DNS enabled
Default Domain Name:
    sample.com
Domain Name List:
    sample.com.jp
    sample.com.uk
Name Server List:
    192.168.1.55
    10.1.0.55
SSE-G2252#
```

show dns cache

This command displays entries in the DNS cache.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show dns cache
No.     Flag    Type    IP Address      TTL     Domain
------- ------- ------- --------------- ------- --------
      3       4 Host    209.131.36.158      115 www-real.wa1.b.yahoo.com
      4       4 CNAME   POINTER TO:3        115 www.yahoo.com
      5       4 CNAME   POINTER TO:3        115 www.wa1.b.yahoo.com
SSE-G2252#
```

Table 40-2. show dns cache - Display Description

Field	Description
No.	The entry number for each resource record.
Flag	The flag is always “4” indicating a cache entry and therefore unreliable.
Type	This field includes “Host” which specifies the primary name for the owner, and “CNAME” which specifies multiple domain names (or aliases) which are mapped to the same IP address as an existing entry.
IP Address	The IP address associated with this record.
TTL	The time to live reported by the name server.
Domain	The domain name associated with this record.

show hosts

This command displays the static host name-to-address mapping table.

Command Mode

Privileged Exec

Example

Note that a host name will be displayed as an alias if it is mapped to the same address(es) as a previously configured entry.

```
SSE-G2252#show hosts
No.  Flag Type    IP Address            TTL   Domain
---- ---- ------- --------------------  -----
------------------------------
   0    2 Address 192.168.1.55                rd5
   1    2 Address 2001:DB8:1::12              rd6
   3    4 Address 209.131.36.158           65 www-real.wa1.b.yahoo.com
   4    4 CNAME   POINTER TO:3              65 www.yahoo.com
   5    4 CNAME   POINTER TO:3              65 www.wa1.b.yahoo.com
SSE-G2252#
```

Table 40-3. show hosts - Display Description

Field	Description
No.	The entry number for each resource record.
Flag	The field displays "2" for a static entry, or "4" for a dynamic entry stored in the cache.
Type	This field includes "Address" which specifies the primary name for the owner, and "CNAME" which specifies multiple domain names (or aliases) which are mapped to the same IP address as an existing entry.
IP Address	The IP address associated with this record.
TTL	The time to live reported by the name server. This field is always blank for static entries.
Domain	The domain name associated with this record.

Chapter 41
DHCP Commands

These commands are used to configure Dynamic Host Configuration Protocol (DHCP) client functions.

Table 41-1. DHCP Commands

Command Group	Function
DHCP Client	Allows interfaces to dynamically acquire IP address information

41-1 DHCP Client

Use the commands in this section to allow the switch's VLAN interfaces to dynamically acquire IP address information.

NOTE: DHCPv6 stateful configuration of IP address prefixes is not supported in the current software release. If the router advertisements have the "other stateful configuration" flag set, the switch will attempt to acquire other non-address configuration information (such as a default gateway) from a DHCPv6 server.

Table 41-2. DHCP Client Commands

Command	Function	Mode
DHCP for IPv4		
ip dhcp client class-id	Specifies the DHCP client identifier for an interface	IC
ip dhcp restart client	Submits a BOOTP or DHCP client request	PE
DHCP for IPv6		
ipv6 dhcp restart client vlan	Submits a DHCPv6 client request	PE
show ip dhcp client-identifier	Shows the DHCP client identifier for all interfaces	PE
show ipv6 dhcp duid	Shows the DHCP Unique Identifier for this switch	PE
show ipv6 dhcp vlan	Shows DHCPv6 information for specified interface	PE

ip dhcp client class-id

This command specifies the DCHP client vendor class identifier for the current interface. Use the **no** form to remove this identifier.

Syntax

ip dhcp client class-id [**text** *text* | **hex** *hex*]

no ip dhcp client class-id

text - A text string. (Range: 1-32 characters)

hex - A hexadecimal value.

Default Setting

None

Command Mode

Interface Configuration (VLAN)

Command Usage

- Use this command without any keywords to enable this identifier.
- This command is used to identify the vendor class and configuration of the switch to the DHCP server, which then uses this information to decide on how to service the client or the type of information to return.
- The general framework for this DHCP option is set out in RFC 2132 (Option 60). This information is used to convey configuration settings or other identification information about a client, but the specific string to use should be supplied by your service provider or network administrator.
- The server should reply with Option 43 information, which encapsulates Option 66 attributes including the TFTP server name and boot file name.

Example

```
SSE-G2252(config)#interface vlan 2
SSE-G2252(config-if)#ip dhcp client class-id hex 0000e8666572
SSE-G2252(config-if)#
```

Related Commands

"ip dhcp restart client" on page 41-3

ip dhcp restart client

This command submits a BOOTP or DHCP client request.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- This command issues a BOOTP or DHCP client request for any IP interface that has been set to BOOTP or DHCP mode through the ip address command.
- DHCP requires the server to reassign the client's last address if available.
- If the BOOTP or DHCP server has been moved to a different domain, the network portion of the address provided to the client will be based on this new domain.

Example

In the following example, the device is reassigned the same address.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ip address dhcp
SSE-G2252(config-if)#exit
SSE-G2252#ip dhcp restart client
SSE-G2252#show ip interface
Vlan 1 is Administrative Up - Link Up
  Address is 12-34-12-34-12-34 (bia 12-34-12-34-12-34)
  Index: 1001, MTU: 1500, Bandwidth: 1g
  Address Mode is DHCP
  IP Address: 192.168.0.9 Mask: 255.255.255.0
  Proxy ARP is disabled
SSE-G2252#
```

Related Commands

"ip address" on page 42-2

ipv6 dhcp restart client vlan

This command submits a DHCPv6 client request.

Syntax

ipv6 dhcp restart client vlan *vlan-id*

vlan-id - VLAN ID, specified as a single number, a range of consecutive numbers separated by a hyphen, or multiple numbers separated by commas. (Range: 1-4093, no leading zeroes)

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- This command starts the DHCPv6 client process if it is not yet running by submitting requests for address prefix delegation through the specified interface(s).
- When the DHCP client process is enabled and a prefix is successfully acquired, the prefix is stored in the IPv6 general prefix pool. Other commands and applications (such as the ipv6 address command) can then refer to the prefixes in the general prefix pool.
- DHCPv6 clients can also request configuration parameters that do not require a server to maintain any dynamic state for individual clients, such as DNS server addresses.
- DHCPv6 clients builds a list of servers by sending a solicit message and collecting advertised message replies. These servers are then ranked based on their advertised preference value. If the client needs to acquire prefixes from servers, only servers that have advertised prefixes are considered.

Example

The following command submits a client request on VLAN 1.

```
SSE-G2252#ipv6 dhcp restart client vlan 1
SSE-G2252#
```

Related Commands

"ipv6 address" on page 42-13

show ip dhcp client-identifier

This command shows the DHCP client identifier for all interfaces.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip dhcp client-identifier
Interface     mode      client-identifier
---------     ----      -----------------
VLAN1         TEXT      michelle
VLAN2         TEXT      bill
VLAN3         TEXT      steve
SSE-G2252#
```

show ipv6 dhcp duid

This command shows the DHCP Unique Identifier for this switch.

Command Mode

Privileged Exec

Command Usage

DHCPv6 clients and servers are identified by a DHCP Unique Identifier (DUID) included in the client identifier and server identifier options. Static or dynamic address prefixes may be assigned by a DHCPv6 server based on the client's DUID.

Example

```
SSE-G2252#show ipv6 dhcp duid
DHCPv6 Unique Identifier (DUID): 0001-0001-4A8158B4-00E00C0000FD
SSE-G2252#
```

show ipv6 dhcp vlan

This command shows DHCPv6 information for the specified interface(s).

Syntax

show ipv6 dhcp vlan *vlan-id*

vlan-id - VLAN ID, specified as a single number, a range of consecutive numbers separated by a hyphen, or multiple numbers separated by commas. (Range: 1-4093, no leading zeroes)

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ipv6 dhcp vlan 1
VLAN 1 is in DHCP client mode, Rapid-Commit
 List of known servers:
  Server address : FE80::250:FCFF:FEF9:A494
  DUID           : 0001-0001-48CFB0D5-F48F2A006801

  Server address : FE80::250:FCFF:FEF9:A405
  DUID           : 0001-0001-38CF5AB0-F48F2A003917
SSE-G2252#
```

Chapter 42
IP Interface Commands

An IP Version 4 and Version 6 address may be used for management access to the switch over the network. Both IPv4 or IPv6 addresses can be used simultaneously to access the switch. You can manually configure a specific IPv4 or IPv6 address or direct the switch to obtain an IPv4 address from a BOOTP or DHCP server when it is powered on. An IPv6 address can either be manually configured or dynamically generated.

An IPv4 address for this switch is obtained via DHCP by default for VLAN 1. You may also need to a establish an IPv4 or IPv6 default gateway between this device and management stations that exist on another network segment.

Table 42-1. IP Interface Commands

Command Group	Function
IPv4 Interface	Configures an IPv4 address for the switch
IPv6 Interface	Configures an IPv6 address for the switch

42-1 IPv4 Interface

There are no IP addresses assigned to this switch by default. You must manually configure a new address to manage the switch over your network or to connect the switch to existing IP subnets. You may also need to a establish a default gateway between this device and management stations or other devices that exist on another network segment

This section includes commands for configuring IP interfaces, the Address Resolution Protocol (ARP) and Proxy ARP.

Table 42-2. IPv4 Interface Commands

Command Group	Function
Basic IPv4 Configuration	Configures the IP address for interfaces and the gateway router
ARP Configuration	Configures static, dynamic and proxy ARP service

Basic IPv4 Configuration

This section describes commands used to configure IP addresses for VLAN interfaces on the switch.

Table 42-3. Basic IP Configuration Commands

Command	Function	Mode
ip address	Sets the IP address for the current interface	IC
ip default-gateway	Defines the default gateway through which this router can reach other subnetworks	GC
show ip default-gateway	Displays the default gateway configured for this device	PE
show ip interface	Displays the IP settings for this device	PE
traceroute	Shows the route packets take to the specified host	PE
ping	Sends ICMP echo request packets to another node on the network	NE, PE

ip address

This command sets the IPv4 address for the currently selected VLAN interface. Use the **no** form to restore the default IP address.

Syntax

ip address {*ip-address netmask* | **bootp** | **dhcp**}

no ip address

ip-address - IP address

netmask - Network mask for the associated IP subnet. This mask identifies the host address bits used for routing to specific subnets.

bootp - Obtains IP address from BOOTP.

dhcp - Obtains IP address from DHCP.

Default Setting

IP Address: 192.168.100.102

Subnet Mask: 255.255.255.0

Command Mode

Interface Configuration (VLAN)

Command Usage

- An IP address must be assigned to this device to gain management access over the network or to connect the switch to existing IP subnets. A specific IP address can be manually configured, or the switch can be directed to obtain an address from a BOOTP or DHCP server. Valid IP addresses consist of four numbers, 0 to 255, separated by periods. Anything other than this format is not be accepted by the configuration program.
- If **bootp** or **dhcp** options are selected, the system will immediately start broadcasting service requests for all VLANs configured to obtain address assignments through BOOTP or DHCP. IP is enabled but will not function until a BOOTP or DHCP reply has been received. Requests are broadcast periodically by the router in an effort to learn its IP address. (BOOTP and DHCP values can include the IP address, default gateway, and subnet mask). If the DHCP/BOOTP server is slow to respond, you may need to use the ip dhcp restart client command to re-start broadcasting service requests, or reboot the switch.

Example

In the following example, the device is assigned an address in VLAN 1.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ip address 192.168.1.5 255.255.255.0
SSE-G2252(config-if)#
```

Related Commands

"ip dhcp restart client" on page 41-3

"ipv6 address" on page 42-13

ip default-gateway

This command specifies the default gateway for destinations not found in the local routing tables. Use the **no** form to remove a default gateway.

Syntax

ip default-gateway *gateway*

no ip default-gateway

gateway - IP address of the default gateway

Default Setting

No default gateway is established.

Command Mode

Global Configuration

Command Usage

- A default gateway can only be successfully set when a network interface that directly connects to the gateway has been configured on the switch.
- A gateway must be defined if the management station is located in a different IP segment.

Example

The following example defines a default gateway for this device:

```
SSE-G2252(config)#ip default-gateway 10.1.1.254
SSE-G2252(config)#
```

Related Commands

"ipv6 default-gateway" on page 42-12

show ip default-gateway

This command shows the IPv4 default gateway configured for this device.

Default Setting

None

Command Mode

Privileged Exec

Example

```
Console#show ip redirects
ip default gateway 10.1.0.254
Console#
```

Related Commands

"ip default-gateway" on page 42-4

"show ipv6 default-gateway" on page 42-20

show ip interface

This command displays the settings of an IPv4 interface.

Command Mode

Privileged Exec

Example

```
SSE-G2252#show ip interface
Vlan 1 is Administrative Up - Link Up
  Address is 00-E0-0C-00-00-FD (via 00-E0-0C-00-00-FD)
  Index: 1001, MTU: 1500, Bandwidth: 1g
  Address Mode is DHCP
  IP Address: 192.168.0.3 Mask: 255.255.255.0
  Proxy ARP is disabled
SSE-G2252#
```

Related Commands

"ip address" on page 42-2

"show ipv6 interface" on page 42-21

traceroute

This command shows the route packets take to the specified destination.

Syntax

traceroute *host*

host - IP address or alias of the host.

Default Setting

None

Command Mode

Privileged Exec

Command Usage

- Use the **traceroute** command to determine the path taken to reach a specified destination.
- A trace terminates when the destination responds, when the maximum time out (TTL) is exceeded, or the maximum number of hops is exceeded.
- The traceroute command first sends probe datagrams with the TTL value set at one. This causes the first router to discard the datagram and return an error message. The trace function then sends several probe messages at each subsequent TTL level and displays the round-trip time for each message. Not all devices respond correctly to probes by returning an "ICMP port unreachable" message. If the timer goes off before a response is returned, the trace function prints a series of asterisks and the "Request Timed Out" message. A long sequence of these messages, terminating only when the maximum time out has been reached, may indicate this problem with the target device.

Example

```
SSE-G2252#traceroute 192.168.0.1
Press "ESC" to abort.

Source address:         192.168.0.9
Destination address:    192.168.0.1

Hop    IP Address            Packet 1          Packet 2          Packet 3
-------------------------------------------------------------------------
--
1    192.168.0.1               <10 ms            <10 ms            <10 ms

Trace completed.
SSE-G2252#
```

ping

This command sends (IPv4) ICMP echo request packets to another node on the network.

Syntax

ping *host* [**count** *count*] [**size** *size*]

host - IP address or IP alias of the host.

count - Number of packets to send. (Range: 1-16)

size - Number of bytes in a packet (Range: 32-512). The actual packet size will be eight bytes larger than the size specified because the router adds header information.

Default Setting

count: 5

size: 32 bytes

Command Mode

Normal Exec, Privileged Exec

Command Usage

- Use the ping command to see if another site on the network can be reached.
- The following are some results of the **ping** command:
  - *Normal response* - The normal response occurs in one to ten seconds, depending on network traffic.
  - *Destination does not respond* - If the host does not respond, a “timeout” appears in ten seconds.
  - *Destination unreachable* - The gateway for this destination indicates that the destination is unreachable.
  - *Network or host unreachable* - The gateway found no corresponding entry in the route table.
- When pinging a host name, be sure the DNS servers have been specified (see page 40-6) and host name-to-address translation enabled (page 40-3). If necessary, local devices can also be specified in the DNS static host table (see page 40-5).

Example

```
SSE-G2252#ping 10.1.0.9
Type ESC to abort.
PING to 10.1.0.9, by 5 32-byte payload ICMP packets, timeout is 5 seconds
response time: 10 ms
response time: 10 ms
response time: 10 ms
response time: 10 ms
response time: 0 ms
Ping statistics for 10.1.0.9:
 5 packets transmitted, 5 packets received (100%), 0 packets lost (0%)
Approximate round trip times:
 Minimum = 0 ms, Maximum = 10 ms, Average = 8 ms
SSE-G2252#
```

Related Commands

"interface" on page 27-2

ARP Configuration

This section describes commands used to configure the Address Resolution Protocol (ARP) on the switch.

Table 42-4. Address Resolution Protocol Commands

Command	Function	Mode
arp timeout	Sets the time a dynamic entry remains in the ARP cache	GC
clear arp-cache	Deletes all dynamic entries from the ARP cache	PE
show arp	Displays entries in the ARP cache	NE, PE

arp timeout

This command sets the aging time for dynamic entries in the Address Resolution Protocol (ARP) cache. Use the **no** form to restore the default timeout.

Syntax

arp timeout *seconds*

no arp timeout

seconds - The time a dynamic entry remains in the ARP cache. (Range: 300-86400; 86400 seconds is one day)

Default Setting

1200 seconds (20 minutes)

Command Mode

Global Configuration

Command Usage

- When a ARP entry expires, it is deleted from the cache and an ARP request packet is sent to re-establish the MAC address.
- The aging time determines how long dynamic entries remain in the cache. If the timeout is too short, the switch may tie up resources by repeating ARP requests for addresses recently flushed from the table.

Example

This example sets the ARP cache timeout for 15 minutes (i.e., 900 seconds).

```
SSE-G2252(config)#arp timeout 900
SSE-G2252(config)#
```

clear arp-cache

This command deletes all dynamic entries from the Address Resolution Protocol (ARP) cache.

Command Mode

Privileged Exec

Example

This example clears all dynamic entries in the ARP cache.

```
SSE-G2252#clear arp-cache
This operation will delete all the dynamic entries in ARP Cache.
Are you sure to continue this operation (y/n)?y
SSE-G2252#
```

show arp

This command displays entries in the Address Resolution Protocol (ARP) cache.

Command Mode

Normal Exec, Privileged Exec

Command Usage

This command displays information about the ARP cache. The first line shows the cache timeout. It also shows each cache entry, including the IP address, MAC address, type (static, dynamic, other), and VLAN interface. Note that entry type "other" indicates local addresses for this router.

Example

This example displays all entries in the ARP cache.

```
SSE-G2252#show arp
ARP Cache Timeout: 1200 (seconds)

IP Address      MAC Address       Type      Interface
--------------- ----------------- --------- -----------
10.1.0.0        FF-FF-FF-FF-FF-FF other     VLAN1
10.1.0.254      00-00-AB-CD-00-00 other     VLAN1
10.1.0.255      FF-FF-FF-FF-FF-FF other     VLAN1
123.20.10.123   02-10-20-30-40-50 static    VLAN2
145.30.20.23    09-50-40-30-20-10 dynamic   VLAN3

Total entry : 5
SSE-G2252#
```

42-2 IPv6 Interface

This switch supports the following IPv6 interface commands.

Table 42-5. IPv6 Configuration Commands

Command	Function	Mode
Interface Address Configuration and Utilities		
ipv6 default-gateway	Sets an IPv6 default gateway for traffic	GC
ipv6 address	Configures an IPv6 global unicast address, and enables IPv6 on an interface	IC
ipv6 address autoconfig	Enables automatic configuration of IPv6 global unicast addresses on an interface and enables IPv6 on the interface	IC
ipv6 address eui-64	Configures an IPv6 global unicast address for an interface using an EUI-64 interface ID in the low order 64 bits, and enables IPv6 on the interface	IC
ipv6 address link-local	Configures an IPv6 link-local address for an interface and enables IPv6 on the interface	IC
ipv6 enable	Enables IPv6 on an interface that has not been configured with an explicit IPv6 address	IC
show ipv6 default-gateway	Displays the current IPv6 default gateway	NE, PE
show ipv6 interface	Displays the usability and configured settings for IPv6 interfaces	NE, PE
show ipv6 traffic	Displays statistics about IPv6 traffic	NE, PE
clear ipv6 traffic	Resets IPv6 traffic counters	PE
ping6	Sends IPv6 ICMP echo request packets to another node on the network	PE
Neighbor Discovery		
clear ipv6 neighbors	Deletes all dynamic entries in the IPv6 neighbor discovery cache	PE
show ipv6 neighbors	Displays information in the IPv6 neighbor discovery cache	PE

ipv6 default-gateway

This command sets an IPv6 default gateway to use when the destination is located in a different network segment. Use the **no** form to remove a previously configured default gateway.

Syntax

ipv6 default-gateway *ipv6-address*

no ipv6 address

ipv6-address - The IPv6 address of the default next hop router to use when the destination is located in a different network segment.

Default Setting

No default gateway is defined

Command Mode

Global Configuration

Command Usage

- All IPv6 addresses must be according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.
- The same link-local address may be used by different interfaces/nodes in different zones (RFC 4007). Therefore, when specifying a link-local address, include zone-id information indicating the VLAN identifier after the % delimiter. For example, FE80::7272%1 identifies VLAN 1 as the interface from which the ping is sent.
- An IPv6 default gateway must be defined if the destination has been assigned an IPv6 address and is located in a different IP segment.
- An IPv6 default gateway can only be successfully set when a network interface that directly connects to the gateway has been configured on the switch.

Example

The following example defines a default gateway for this device:

```
SSE-G2252(config)#ipv6 default-gateway FE80::269:3EF9:FE19:6780
SSE-G2252(config)#
```

Related Commands

"show ipv6 default-gateway" on page 42-20

"ip default-gateway" on page 42-4

ipv6 address

This command configures an IPv6 global unicast address and enables IPv6 on an interface. Use the **no** form without any arguments to remove all IPv6 addresses from the interface, or use the **no** form with a specific IPv6 address to remove that address from the interface.

Syntax

[**no**] **ipv6 address** *ipv6-address/prefix-length*

ipv6-address - A full IPv6 address including the network prefix and host address bits.

prefix-length - A decimal value indicating how many contiguous bits (from the left) of the address comprise the prefix (i.e., the network portion of the address).

Default Setting

No IPv6 addresses are defined

Command Mode

Interface Configuration (VLAN)

Command Usage

- All IPv6 addresses must be according to RFC 2373 “IPv6 Addressing Architecture,” using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.
- To connect to a larger network with multiple subnets, you must configure a global unicast address. This address can be manually configured with this command, or it can be automatically configured using the ip ipv6 address autoconfig command.
- If a link-local address has not yet been assigned to this interface, this command will assign the specified static global unicast address and also dynamically generate a link-local unicast address for the interface. (The link-local address is made with an address prefix of FE80 and a host portion based the switch’s MAC address in modified EUI-64 format.)
- If a duplicate address is detected, a warning message is sent to the console.

Example

This example specifies a full IPv6 address and prefix length.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ipv6 address 2001:DB8:2222:7272::72/96
SSE-G2252(config-if)#end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::2E0:CFF:FE00:FD/64
Global unicast address(es):
  2001:DB8:2222:7272::72/96, subnet is 2001:DB8:2222:7272::/96
Joined group address(es):
FF02::1:FF00:72
FF02::1:FF00:FD
FF02::1
IPv6 link MTU is 1500 bytes
ND DAD is enabled, number of DAD attempts: 3.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Related Commands

"ipv6 address eui-64" on page 42-16

"ipv6 address autoconfig" on page 42-14

"show ipv6 interface" on page 42-21

"ip address" on page 42-2

ipv6 address autoconfig

This command enables stateless autoconfiguration of IPv6 addresses on an interface and enables IPv6 on the interface. The network portion of the address is based on prefixes received in IPv6 router advertisement messages; the host portion in based on the modified EUI-64 form of the interface identifier (i.e., the switch's MAC address). Use the **no** form to remove the address generated by this command.

Syntax

[**no**] **ipv6 address autoconfig**

Default Setting

No IPv6 addresses are defined

Command Mode

Interface Configuration (VLAN)

Command Usage

- If a link local address has not yet been assigned to this interface, this command will dynamically generate a global unicast address and a link local address for the interface. (The link-local address is made with an address prefix of FE80 and a host portion based the switch's MAC address in modified EUI-64 format.)
- If a duplicate address is detected, a warning message is sent to the console.
- If the router advertisements have the "other stateful configuration" flag set, the switch will attempt to acquire other non-address configuration information (such as a default gateway).

Example

This example assigns two dynamic global unicast address of 2005::212:CFFF:FE0B:4600 and 3FFE:501:FFFF:100:212:CFFF:FE0B:4600 to the switch.

```
SSE-G2252(config-if)#ipv6 address autoconfig
SSE-G2252(config-if)#end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::212:CFFF:FE0B:4600/64
Global unicast address(es):
  2005::212:CFFF:FE0B:4600, subnet is 2005:0:0:0::/64
  3FFE:501:FFFF:100:212:CFFF:FE0B:4600, subnet is 3FFE:501:FFFF:100::/64
Joined group address(es):
  FF01::1/16
  FF02::1/16
  FF02::1:FF0B:4600/104
MTU is 1500 bytes.
ND DAD is enabled, number of DAD attempts: 1.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Related Commands

"ipv6 address" on page 42-13

"show ipv6 interface" on page 42-21

ipv6 address eui-64

This command configures an IPv6 address for an interface using an EUI-64 interface ID in the low order 64 bits and enables IPv6 on the interface. Use the **no** form without any arguments to remove all manually configured IPv6 addresses from the interface. Use the **no** form with a specific address to remove it from the interface.

Syntax

ipv6 address *ipv6-prefix/prefix-length eui*-**64**

no ipv6 address [*ipv6-prefix/prefix-length* **eui-64**]

ipv6-prefix - The IPv6 network portion of the address assigned to the interface.

prefix-length - A decimal value indicating how many contiguous bits (from the left) of the address comprise the prefix (i.e., the network portion of the address).

Default Setting

No IPv6 addresses are defined

Command Mode

Interface Configuration (VLAN)

Command Usage

- The prefix must be formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.
- If a link local address has not yet been assigned to this interface, this command will dynamically generate a global unicast address and a link-local address for this interface. (The link-local address is made with an address prefix of FE80 and a host portion based the switch's MAC address in modified EUI-64 format.)
- Note that the value specified in the ipv6-prefix may include some of the high-order host bits if the specified prefix length is less than 64 bits. If the specified prefix length exceeds 64 bits, then the network portion of the address will take precedence over the interface identifier.
- If a duplicate address is detected, a warning message is sent to the console.
- IPv6 addresses are 16 bytes long, of which the bottom 8 bytes typically form a unique host identifier based on the device's MAC address. The EUI-64 specification is designed for devices that use an extended 8-byte MAC address. For devices that still use a 6-byte MAC address (also known as EUI-48 format), it must be converted into EUI-64 format by inverting the universal/local bit in the address and inserting the hexadecimal number FFFE between the upper and lower three bytes of the MAC address.

- For example, if a device had an EUI-48 address of 28-9F-18-1C-82-35, the global/local bit must first be inverted to meet EUI-64 requirements (i.e., 1 for globally defined addresses and 0 for locally defined addresses), changing 28 to 2A. Then the two bytes FFFE are inserted between the OUI (i.e., company id) and the rest of the address, resulting in a modified EUI-64 interface identifier of 2A-9F-18-FF-FE-1C-82-35.
- This host addressing method allows the same interface identifier to be used on multiple IP interfaces of a single device, as long as those interfaces are attached to different subnets.

Example

This example uses the network prefix of 2001:0DB8:0:1::/64, and specifies that the EUI-64 interface identifier be used in the lower 64 bits of the address.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ipv6 address 2001:0DB8:0:1::/64 eui-64
SSE-G2252(config-if)#end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::2E0:CFF:FE00:FD/64
Global unicast address(es):
  2001:DB8::1:2E0:CFF:FE00:FD/64, subnet is 2001:DB8::1:0:0:0:0/64[EUI]
  2001:DB8:2222:7272::72/96, subnet is 2001:DB8:2222:7272::/96[EUI]
Joined group address(es):
FF02::1:FF00:72
FF02::1:FF00:FD
FF02::1
IPv6 link MTU is 1500 bytes
ND DAD is enabled, number of DAD attempts: 3.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Related Commands

"ipv6 address autoconfig" on page 42-14

"show ipv6 interface" on page 42-21

ipv6 address link-local

This command configures an IPv6 link-local address for an interface and enables IPv6 on the interface. Use the **no** form without any arguments to remove all manually configured IPv6 addresses from the interface. Use the **no** form with a specific address to remove it from the interface.

Syntax

ipv6 address *ipv6-address* **link-local**

no ipv6 address [*ipv6-address* **link-local**]

ipv6-address - The IPv6 address assigned to the interface.

Default Setting

No IPv6 addresses are defined

Command Mode

Interface Configuration (VLAN)

Command Usage

- The specified address must be formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields. And the address prefix must be FE80.
- The address specified with this command replaces a link-local address that was automatically generated for the interface.
- You can configure multiple IPv6 global unicast addresses per interface, but only one link-local address per interface.
- If a duplicate address is detected, a warning message is sent to the console.

Example

This example assigns a link-local address of FE80::269:3EF9:FE19:6779 to VLAN 1. Note that the prefix FE80 is required for link-local addresses, and the first 16-bit group in the host address is padded with a zero in the form 0269.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ipv6 address FE80::269:3EF9:FE19:6779 link-local
SSE-G2252(config-if)#end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::269:3EF9:FE19:6779/64
Global unicast address(es):
  2001:DB8::1:2E0:CFF:FE00:FD/64, subnet is 2001:DB8::1:0:0:0:0/64[EUI]
  2001:DB8:2222:7272::72/96, subnet is 2001:DB8:2222:7272::/96[EUI]
```

```
Joined group address(es):
FF02::1:FF19:6779
FF02::1:FF00:72
FF02::1:FF00:FD
FF02::1
IPv6 link MTU is 1500 bytes
ND DAD is enabled, number of DAD attempts: 3.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Related Commands

"ipv6 enable" on page 42-19

"show ipv6 interface" on page 42-21

ipv6 enable

This command enables IPv6 on an interface that has not been configured with an explicit IPv6 address. Use the **no** form to disable IPv6 on an interface that has not been configured with an explicit IPv6 address.

Syntax

[**no**] **ipv6 enable**

Default Setting

IPv6 is disabled

Command Mode

Interface Configuration (VLAN)

Command Usage

- This command enables IPv6 on the current VLAN interface and automatically generates a link-local unicast address. The address prefix uses FE80, and the host portion of the address is generated by converting the switch's MAC address to modified EUI-64 format (see "ipv6 address eui-64" on page 42-16). This address type makes the switch accessible over IPv6 for all devices attached to the same local subnet.
- If a duplicate address is detected on the local segment, this interface will be disabled and a warning message displayed on the console.
- The **no ipv6 enable** command does not disable IPv6 for an interface that has been explicitly configured with an IPv6 address.

Example

In this example, IPv6 is enabled on VLAN 1, and the link-local address FE80::2E0:CFF:FE00:FD/64 is automatically generated by the switch.

```
SSE-G2252(config)#interface vlan 1
SSE-G2252(config-if)#ipv6 enable
SSE-G2252(config-if)#end
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::2E0:CFF:FE00:FD/64
Global unicast address(es):
  2001:DB8:2222:7273::72/96, subnet is 2001:DB8:2222:7273::/96
Joined group address(es):
FF02::1:FF00:72
FF02::1:FF00:FD
FF02::1
IPv6 link MTU is 1280 bytes
ND DAD is enabled, number of DAD attempts: 3.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Related Commands

"ipv6 address link-local" on page 42-18

"show ipv6 interface" on page 42-21

show ipv6 default-gateway

This command displays the current IPv6 default gateway.

Command Mode

Normal Exec, Privileged Exec

Example

The following shows the default gateway configured for this device:

```
SSE-G2252#show ipv6 default-gateway
IPv6 default gateway 2001:DB8:2222:7272::254

SSE-G2252#
```

show ipv6 interface

This command displays the usability and configured settings for IPv6 interfaces.

Syntax

show ipv6 interface [**brief** [**vlan** *vlan-id* [*ipv6-prefix/prefix-length*]]]

brief - Displays a brief summary of IPv6 operational status and the addresses configured for each interface.

vlan-id - VLAN ID (Range: 1-4093)

ipv6-prefix - The IPv6 network portion of the address assigned to the interface. The prefix must be formatted according to RFC 2373 “IPv6 Addressing Architecture,” using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.

prefix-length - A decimal value indicating how many of the contiguous bits (from the left) of the address comprise the prefix (i.e., the network portion of the address).

Command Mode

Normal Exec, Privileged Exec

Example

This example displays all the IPv6 addresses configured for the switch.

```
SSE-G2252#show ipv6 interface
VLAN 1 is up
IPv6 is enabled.
Link-local address:
  FE80::2E0:CFF:FE00:FD/64
Global unicast address(es):
  2001:DB8:2222:7273::72/96, subnet is 2001:DB8:2222:7273::/96
Joined group address(es):
FF02::1:FF00:72
FF02::1:FF00:FD
FF02::1
IPv6 link MTU is 1280 bytes
ND DAD is enabled, number of DAD attempts: 3.
ND retransmit interval is 1000 milliseconds

SSE-G2252#
```

Table 42-6. show ipv6 interface - Display Description

Field	Description
VLAN	A VLAN is marked "up" if the switch can send and receive packets on this interface, "down" if a line signal is not present, or "administratively down" if the interface has been disabled by the administrator.
IPv6	IPv6 is marked "enable" if the switch can send and receive IP traffic on this interface, "disable" if the switch cannot send and receive IP traffic on this interface, or "stalled" if a duplicate link-local address is detected on the interface.
Link-local address	Shows the link-local address assigned to this interface
Global unicast address(es)	Shows the global unicast address(es) assigned to this interface
Joined group address(es)	In addition to the unicast addresses assigned to an interface, a host is also required to listen to all-nodes multicast addresses FF01::1 (interface-local scope) and FF02::1 (link-local scope). FF01::1/16 is the transient interface-local multicast address for all attached IPv6 nodes, and FF02::1/16 is the link-local multicast address for all attached IPv6 nodes. The interface-local multicast address is only used for loopback transmission of multicast traffic. Link-local multicast addresses cover the same types as used by link-local unicast addresses, including all nodes (FF02::1), all routers (FF02::2), and solicited nodes (FF02::1:FFXX:XXXX) as described below. A node is also required to compute and join the associated solicited-node multicast addresses for every unicast and anycast address it is assigned. IPv6 addresses that differ only in the high-order bits, e.g. due to multiple high-order prefixes associated with different aggregations, will map to the same solicited-node address, thereby reducing the number of multicast addresses a node must join. In this example, FF02::1:FF90:0/104 is the solicited-node multicast address which is formed by taking the low-order 24 bits of the address and appending those bits to the prefix.
ND DAD	Indicates whether (neighbor discovery) duplicate address detection is enabled.
number of DAD attempts	The number of consecutive neighbor solicitation messages sent on the interface during duplicate address detection.
ND retransmit interval	The interval between IPv6 neighbor solicitation retransmissions sent on an interface during duplicate address detection.

This example displays a brief summary of IPv6 addresses configured on the switch.

```
SSE-G2252#show ipv6 interface brief
Interface       VLAN       IPv6       IPv6 Address
--------------- ---------- ---------- ----------------------------------
VLAN 1          Up         Up         2001:DB8:2222:7273::72/96
VLAN 1          Up         Up         FE80::2E0:CFF:FE00:FD%1/64
SSE-G2252#
```

Related Commands

"show ip interface" on page 42-5

show ipv6 traffic

This command displays statistics about IPv6 traffic passing through this switch.

Command Mode

Normal Exec, Privileged Exec

Example

The following example shows statistics for all IPv6 unicast and multicast traffic, as well as ICMP, UDP and TCP statistics:

```
SSE-G2252#show ipv6 traffic
IPv6 Statistics:
IPv6 received
                    total received
                    header errors
                    too big errors
                    no routes
                    address errors
                    unknown protocols
                    truncated packets
                    discards
                    delivers
                    reassembly request datagrams
                    reassembled succeeded
                    reassembled failed
IPv6 sent
                    forwards datagrams
                 15 requests
                    discards
                    no routes
                    generated fragments
                    fragment succeeded
                    fragment failed
ICMPv6 Statistics:
ICMPv6 received
                    input
                    errors
                    destination unreachable messages
                    packet too big messages
                    time exceeded messages
                    parameter problem message
                    echo request messages
                    echo reply messages
                    redirect messages
                    group membership query messages
                    group membership response messages
                    group membership reduction messages
                    router solicit messages
                    router advertisement messages
                    neighbor solicit messages
                    neighbor advertisement messages
                    redirect messages
ICMPv6 sent
                 15 output
                    destination unreachable messages
                    packet too big messages
```

```
                        time exceeded messages
                        parameter problem message
                        echo reply messages
                      7 router solicit messages
                      3 neighbor solicit messages
                        neighbor advertisement messages
                        redirect messages
                        group membership response messages
                        group membership reduction messages
  UDP Statistics:
                        input
                        no port errors
                        other errors
                        output
  SSE-G2252#
```

Table 42-7. show ipv6 traffic - Display Description

Field	Description
IPv6 Statistics	
IPv6 received	
total received	The total number of input datagrams received by the interface, including those received in error.
header errors	The number of input datagrams discarded due to errors in their IPv6 headers, including version number mismatch, other format errors, hop count exceeded, IPv6 options, etc.
too big errors	The number of input datagrams that could not be forwarded because their size exceeded the link MTU of outgoing interface.
no routes	The number of input datagrams discarded because no route could be found to transmit them to their destination.
address errors	The number of input datagrams discarded because the IPv6 address in their IPv6 header's destination field was not a valid address to be received at this entity. This count includes invalid addresses (e.g., ::0) and unsupported addresses (e.g., addresses with unallocated prefixes). For entities which are not IPv6 routers and therefore do not forward datagrams, this counter includes datagrams discarded because the destination address was not a local address.
unknown protocols	The number of locally-addressed datagrams received successfully but discarded because of an unknown or unsupported protocol. This counter is incremented at the interface to which these datagrams were addressed which might not be necessarily the input interface for some of the datagrams.
truncated packets	The number of input datagrams discarded because datagram frame didn't carry enough data.
discards	The number of input IPv6 datagrams for which no problems were encountered to prevent their continued processing, but which were discarded (e.g., for lack of buffer space). Note that this counter does not include any datagrams discarded while awaiting re-assembly.
delivers	The total number of datagrams successfully delivered to IPv6 user-protocols (including ICMP). This counter is incremented at the interface to which these datagrams were addressed which might not be necessarily the input interface for some of the datagrams.

Table 42-7. show ipv6 traffic - Display Description (Continued)

Field	Description
reassembly request datagrams	The number of IPv6 fragments received which needed to be reassembled at this interface. Note that this counter is incremented at the interface to which these fragments were addressed which might not be necessarily the input interface for some of the fragments.
reassembled succeeded	The number of IPv6 datagrams successfully reassembled. Note that this counter is incremented at the interface to which these datagrams were addressed which might not be necessarily the input interface for some of the fragments.
reassembled failed	The number of failures detected by the IPv6 re-assembly algorithm (for whatever reason: timed out, errors, etc.). Note that this is not necessarily a count of discarded IPv6 fragments since some algorithms (notably the algorithm in RFC 815) can lose track of the number of fragments by combining them as they are received. This counter is incremented at the interface to which these fragments were addressed which might not be necessarily the input interface for some of the fragments.
IPv6 sent	
forwards datagrams	The number of output datagrams which this entity received and forwarded to their final destinations. In entities which do not act as IPv6 routers, this counter will include only those packets which were Source-Routed via this entity, and the Source-Route processing was successful. Note that for a successfully forwarded datagram the counter of the outgoing interface is incremented.
requests	The total number of IPv6 datagrams which local IPv6 user-protocols (including ICMP) supplied to IPv6 in requests for transmission. Note that this counter does not include any datagrams counted in ipv6IfStatsOutForwDatagrams.
discards	The number of output IPv6 datagrams for which no problem was encountered to prevent their transmission to their destination, but which were discarded (e.g., for lack of buffer space). Note that this counter would include datagrams counted in ipv6IfStatsOutForwDatagrams if any such packets met this (discretionary) discard criterion.
no routes	The number of input datagrams discarded because no route could be found to transmit them to their destination.
generated fragments	The number of output datagram fragments that have been generated as a result of fragmentation at this output interface.
fragment succeeded	The number of IPv6 datagrams that have been successfully fragmented at this output interface.
fragment failed	The number of IPv6 datagrams that have been discarded because they needed to be fragmented at this output interface but could not be.

Table 42-7. show ipv6 traffic - Display Description (Continued)

Field	Description
ICMPv6 Statistics	
ICMPv6 received	
input	The total number of ICMP messages received by the interface which includes all those counted by ipv6IfIcmpInErrors. Note that this interface is the interface to which the ICMP messages were addressed which may not be necessarily the input interface for the messages.
errors	The number of ICMP messages which the interface received but determined as having ICMP-specific errors (bad ICMP checksums, bad length, etc.).
destination unreachable messages	The number of ICMP Destination Unreachable messages received by the interface.
packet too big messages	The number of ICMP Packet Too Big messages received by the interface.
time exceeded messages	The number of ICMP Time Exceeded messages received by the interface.
parameter problem message	The number of ICMP Parameter Problem messages received by the interface.
echo request messages	The number of ICMP Echo (request) messages received by the interface.
echo reply messages	The number of ICMP Echo Reply messages received by the interface.
redirect messages	The number of Redirect messages received by the interface.
group membership query messages	The number of ICMPv6 Group Membership Query messages received by the interface.
group membership response messages	The number of ICMPv6 Group Membership Response messages received by the interface.
group membership reduction messages	The number of ICMPv6 Group Membership Reduction messages received by the interface.
router solicit messages	The number of ICMP Router Solicit messages received by the interface.
router advertisement messages	The number of ICMP Router Advertisement messages received by the interface.
neighbor solicit messages	The number of ICMP Neighbor Solicit messages received by the interface.
neighbor advertisement messages	The number of ICMP Neighbor Advertisement messages received by the interface.
redirect messages	The number of Redirect messages received by the interface.
ICMPv6 sent	
output	The total number of ICMP messages which this interface attempted to send. Note that this counter includes all those counted by icmpOutErrors.

Table 42-7. show ipv6 traffic - Display Description (Continued)

Field	Description
destination unreachable messages	The number of ICMP Destination Unreachable messages sent by the interface.
packet too big messages	The number of ICMP Packet Too Big messages sent by the interface.
time exceeded messages	The number of ICMP Time Exceeded messages sent by the interface.
parameter problem message	The number of ICMP Parameter Problem messages sent by the interface.
echo reply messages	The number of ICMP Echo Reply messages sent by the interface.
router solicit messages	The number of ICMP Router Solicitation messages sent by the interface.
neighbor advertisement messages	The number of ICMP Router Advertisement messages sent by the interface.
redirect messages	The number of Redirect messages sent. For a host, this object will always be zero, since hosts do not send redirects.
group membership response messages	The number of ICMPv6 Group Membership Response messages sent.
group membership reduction messages	The number of ICMPv6 Group Membership Reduction messages sent.
UDP Statistics	
input	The total number of UDP datagrams delivered to UDP users.
no port errors	The total number of received UDP datagrams for which there was no application at the destination port.
other errors	The number of received UDP datagrams that could not be delivered for reasons other than the lack of an application at the destination port.
output	The total number of UDP datagrams sent from this entity.

clear ipv6 traffic

This command resets IPv6 traffic counters.

Command Mode

Privileged Exec

Command Usage

This command resets all of the counters displayed by the show ipv6 traffic command.

Example

```
SSE-G2252#clear ipv6 traffic
SSE-G2252#
```

ping6

This command sends (IPv6) ICMP echo request packets to another node on the network.

Syntax

ping6 {*ipv6-address* | *host-name*} [**count** *count*] [**size** *size*]

ipv6-address - The IPv6 address of a neighbor device. You can specify either a link-local or global unicast address formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.

host-name - A host name string which can be resolved into an IPv6 address through a domain name server.

count - Number of packets to send. (Range: 1-16)

size - Number of bytes in a packet. (Range: 48-18024 bytes)
The actual packet size will be eight bytes larger than the size specified because the router adds header information.

Default Setting

count: 5

size: 100 bytes

Command Mode

Privileged Exec

Command Usage

- Use the **ping6** command to see if another site on the network can be reached, or to evaluate delays over the path.
- The same link-local address may be used by different interfaces/nodes in different zones (RFC 4007). Therefore, when specifying a link-local address, include zone-id information indicating the VLAN identifier after the % delimiter. For example, FE80::7272%1 identifies VLAN 1 as the interface from which the ping is sent.
- When pinging a host name, be sure the DNS server has been enabled (see page 40-3). If necessary, local devices can also be specified in the DNS static host table (see page 40-5).
- When using ping6 with a host name, the switch first attempts to resolve the alias into an IPv6 address before trying to resolve it into an IPv4 address.

Example

```
SSE-G2252#ping6 FE80::2E0:CFF:FE00:FC%1/64
Type ESC to abort.
PING to FE80::2E0:CFF:FE00:FC%1/64, by 5 32-byte payload ICMP packets,
timeout is 3 seconds
response time: 20 ms    [FE80::2E0:CFF:FE00:FC] seq_no: 1
response time: 0 ms     [FE80::2E0:CFF:FE00:FC] seq_no: 2
response time: 0 ms     [FE80::2E0:CFF:FE00:FC] seq_no: 3
response time: 0 ms     [FE80::2E0:CFF:FE00:FC] seq_no: 4
response time: 0 ms     [FE80::2E0:CFF:FE00:FC] seq_no: 5
Ping statistics for FE80::2E0:CFF:FE00:FC%1/64:
 5 packets transmitted, 5 packets received (100%), 0 packets lost (0%)
Approximate round trip times:
 Minimum = 0 ms, Maximum = 20 ms, Average = 4 ms
SSE-G2252#
```

clear ipv6 neighbors

This command deletes all dynamic entries in the IPv6 neighbor discovery cache.

Command Mode

Privileged Exec

Example

The following deletes all dynamic entries in the IPv6 neighbor cache:

```
SSE-G2252#clear ipv6 neighbors
SSE-G2252#
```

show ipv6 neighbors

This command displays information in the IPv6 neighbor discovery cache.

Syntax

show ipv6 neighbors [**vlan** *vlan-id* | *ipv6-address*]

vlan-id - VLAN ID (Range: 1-4093)

ipv6-address - The IPv6 address of a neighbor device. You can specify either a link-local or global unicast address formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.

Default Setting

All IPv6 neighbor discovery cache entries are displayed.

Command Mode

Privileged Exec

Example

The following shows all known IPv6 neighbors for this switch:

```
SSE-G2252#show ipv6 neighbors
IPv6 Address               Age         Link-layer Addr    State       VLAN
2009:DB9:2229::79          666         00-00-E8-90-00-00  REACH       1
FE80::200:E8FF:FE90:0      671         00-00-E8-90-00-00  REACH       1
SSE-G2252#
```

Table 42-8. show ipv6 neighbors - Display Description

Field	Description
IPv6 Address	IPv6 address of neighbor
Age	The time since the address was verified as reachable (in seconds). A static entry is indicated by the value "Permanent."
Link-layer Addr	Physical layer MAC address.

Table 42-8. show ipv6 neighbors - Display Description (Continued)

Field	Description
State	The following states are used for dynamic entries: INCMP (Incomplete) - Address resolution is being carried out on the entry. A neighbor solicitation message has been sent to the multicast address of the target, but it has not yet returned a neighbor advertisement message. REACH (Reachable) - Positive confirmation was received within the last ReachableTime interval that the forward path to the neighbor was functioning. While in REACH state, the device takes no special action when sending packets. STALE - More than the ReachableTime interval has elapsed since the last positive confirmation was received that the forward path was functioning. While in STALE state, the device takes no action until a packet is sent. DELAY - More than the ReachableTime interval has elapsed since the last positive confirmation was received that the forward path was functioning. A packet was sent within the last DELAY_FIRST_PROBE_TIME interval. If no reachability confirmation is received within this interval after entering the DELAY state, the switch will send a neighbor solicitation message and change the state to PROBE. PROBE - A reachability confirmation is actively sought by resending neighbor solicitation messages every RetransTimer interval until confirmation of reachability is received. UNKNO - Unknown state. The following states are used for static entries: INCMP (Incomplete)-The interface for this entry is down. REACH (Reachable) - The interface for this entry is up. Reachability detection is not applied to static entries in the IPv6 neighbor discovery cache.
VLAN	VLAN interface from which the address was reached.

Related Commands

"show mac-address-table" on page 33-4

Notes

Appendix A
Software Specifications

A-1 Software Features

Management Authentication

Local, RADIUS, TACACS+, Port Authentication (802.1X), HTTPS, SSH, Port Security, IP Filter, DHCP Snooping

Client Access Control

Access Control Lists (512 rules), Port Authentication (802.1X), MAC Authentication, Port Security, DHCP Snooping, IP Source Guard

Port Configuration

100BASE-TX: 10/100 Mbps, half/full duplex

100BASE-FX: 100 Mbps at full duplex (SFP)

1000BASE-T: 10/100 Mbps at half/full duplex, 1000 Mbps at full duplex

1000BASE-SX/LX/LH - 1000 Mbps at full duplex (SFP)

Flow Control

Full Duplex: IEEE 802.3-2005

Half Duplex: Back pressure

Storm Control

Broadcast, multicast, or unicast traffic throttled above a critical threshold

Port Mirroring

50 sessions, one or more source ports to one destination port

Rate Limits

Input/Output Limits

Range configured per port

Port Trunking

Static trunks (Cisco EtherChannel compliant)

Dynamic trunks (Link Aggregation Control Protocol)

Spanning Tree Algorithm

Spanning Tree Protocol (STP, IEEE 802.1D-2004)

Rapid Spanning Tree Protocol (RSTP, IEEE 802.1D-2004)

Multiple Spanning Tree Protocol (MSTP, IEEE 802.1D-2004)

VLAN Support

Up to 256 groups; port-based, protocol-based, tagged (802.1Q),

private VLANs, voice VLANs, IP subnet, MAC-based, GVRP for automatic VLAN learning

Class of Service

Supports four levels of priority

Strict, Shaped Deficit Weighted Round Robin, or strict-WRR queuing

Layer 3/4 priority mapping: IP DSCP

Quality of Service

DiffServ (IPv4/v6) supports class maps, policy maps, and service policies

Multicast Filtering

IGMP Snooping (Layer 2)

Multicast VLAN Registration

Additional Features

BOOTP Client

DHCP Client

DNS Client, Proxy

LLDP (Link Layer Discover Protocol)

RMON (Remote Monitoring, groups 1,2,3,9)

SMTP Email Alerts

SNMP (Simple Network Management Protocol)

SNTP (Simple Network Time Protocol)

A-2 Management Features

In-Band Management

Telnet, web-based HTTP or HTTPS, SNMP manager, or Secure Shell

Out-of-Band Management

RS-232 DB-9 console port

Software Loading

HTTP, FTP or TFTP in-band, or XModem out-of-band

SNMP

Management access via MIB database

Trap management to specified hosts

RMON

Groups 1, 2, 3, 9 (Statistics, History, Alarm, Event)

A-3 Standards

IEEE 802.1AB Link Layer Discovery Protocol

IEEE 802.1D-2004 Spanning Tree Algorithm and traffic priorities

- Spanning Tree Protocol
- Rapid Spanning Tree Protocol
- Multiple Spanning Tree Protocol

IEEE 802.1p Priority tags

IEEE 802.1Q VLAN

IEEE 802.1v Protocol-based VLANs

IEEE 802.1X Port Authentication

IEEE 802.3-2005

- Ethernet, Fast Ethernet, Gigabit Ethernet
- Link Aggregation Control Protocol (LACP)
- Full-duplex flow control (ISO/IEC 8802-3)

IEEE 802.3ac VLAN tagging

DHCP Client (RFC 2131)

DHCPv6 Client (RFC 3315)

HTTPS

ICMP (RFC 792)

IGMP (RFC 1112)

IGMPv2 (RFC 2236)

IGMPv3 (RFC 3376) - partial support

IPv4 IGMP (RFC 3228)

RADIUS+ (RFC 2618)

RMON (RFC 2819 groups 1,2,3,9)

SNMP (RFC 1157)

SNMPv2c (RFC 1901, 2571)

SNMPv3 (RFC DRAFT 2273, 2576, 3410, 3411, 3413, 3414, 3415)

SNTP (RFC 2030)

SSH (Version 2.0)

TELNET (RFC 854, 855, 856)

TFTP (RFC 1350)

A-4 Management Information Bases

Bridge MIB (RFC 1493)

DHCP Option for Civic Addresses Configuration Information (RFC 4776)

Differentiated Services MIB (RFC 3289)

DNS Resolver MIB (RFC 1612)

Entity MIB (RFC 2737)

Ether-like MIB (RFC 2665)

Extended Bridge MIB (RFC 2674)

Extensible SNMP Agents MIB (RFC 2742)

Forwarding Table MIB (RFC 2096)

IGMP MIB (RFC 2933)

Interface Group MIB (RFC 2233)

Interfaces Evolution MIB (RFC 2863)

IP Multicasting related MIBs

IPV6-MIB (RFC 2065)

IPV6-ICMP-MIB (RFC 2066)

IPV6-TCP-MIB (RFC 2052)

IPV6-UDP-MIB (RFC2054)

Link Aggregation MIB (IEEE 802.3ad)

MAU MIB (RFC 3636)

MIB II (RFC 1213)

P-Bridge MIB (RFC 2674P)

Port Access Entity MIB (IEEE 802.1X)

Port Access Entity Equipment MIB

Power Ethernet MIB (RFC 3621)

Private MIB

Q-Bridge MIB (RFC 2674Q)

Quality of Service MIB

RADIUS Authentication Client MIB (RFC 2621)

RMON MIB (RFC 2819)

RMON II Probe Configuration Group (RFC 2021, partial implementation)

SNMP Community MIB (RFC 3584)

SNMP Framework MIB (RFC 3411)

SNMP-MPD MIB (RFC 3412)

SNMP Target MIB, SNMP Notification MIB (RFC 3413)

SNMP User-Based SM MIB (RFC 3414)

SNMP View Based ACM MIB (RFC 3415)

SNMPv2 IP MIB (RFC 2011)

TACACS+ Authentication Client MIB

TCP MIB (RFC 2012)

Trap (RFC 1215)

UDP MIB (RFC 2013)

Notes

Appendix B
Troubleshooting

B-1 Problems Accessing the Management Interface

Table B-1. Troubleshooting Chart

Symptom	Action
Cannot connect using Telnet, web browser, or SNMP software	Be sure the switch is powered up. Check network cabling between the management station and the switch. Check that you have a valid network connection to the switch and that the port you are using has not been disabled. Be sure you have configured the VLAN interface through which the management station is connected with a valid IP address, subnet mask and default gateway. Be sure the management station has an IP address in the same subnet as the switch's IP interface to which it is connected. If you are trying to connect to the switch via the IP address for a tagged VLAN group, your management station, and the ports connecting intermediate switches in the network, must be configured with the appropriate tag. If you cannot connect using Telnet, you may have exceeded the maximum number of concurrent Telnet/SSH sessions permitted. Try connecting again at a later time.
Cannot connect using Secure Shell	If you cannot connect using SSH, you may have exceeded the maximum number of concurrent Telnet/SSH sessions permitted. Try connecting again at a later time. Be sure the control parameters for the SSH server are properly configured on the switch, and that the SSH client software is properly configured on the management station. Be sure you have generated both an RSA and DSA public key on the switch, exported this key to the SSH client, and enabled SSH service. Be sure you have set up an account on the switch for each SSH user, including user name, authentication level, and password. Be sure you have imported the client's public key to the switch (if public key authentication is used).
Cannot access the on-board configuration program via a serial port connection	Be sure you have set the terminal emulator program to VT100 compatible, 8 data bits, 1 stop bit, no parity, and the baud rate set to any of the following (9600, 19200, 38400, 57600, 115200 bps). Check that the null-modem serial cable conforms to the pin-out connections provided in the Installation Guide.
Forgot or lost the password	Contact your local distributor.

B-2 Using System Logs

If a fault does occur, refer to the Installation Guide to ensure that the problem you encountered is actually caused by the switch. If the problem appears to be caused by the switch, follow these steps:

1. Enable logging.
2. Set the error messages reported to include all categories.
3. Enable SNMP.
4. Enable SNMP traps.
5. Designate the SNMP host that is to receive the error messages.
6. Repeat the sequence of commands or other actions that lead up to the error.
7. Make a list of the commands or circumstances that led to the fault. Also make a list of any error messages displayed.
8. Set up your terminal emulation software so that it can capture all console output to a file. Then enter the "show tech-support" command to record all system settings in this file.
9. Contact your distributor's service engineer, and send a detailed description of the problem, along with the file used to record your system settings.

For example:

```
SSE-G2252(config)#logging on
SSE-G2252(config)#logging history flash 7
SSE-G2252(config)#snmp-server host 192.168.1.23
.
.
.
```

Appendix C
License Information

These "SSE-G2252 Series of L2 Switches[1]" products include a software code developed by third parties that are subject to GNU General Public License ("GPL") or GNU Lesser General Public License ("LGPL"). As applicable, the terms of the GPL and LGPL, and information obtaining access to the GPL Code and LGPL Code used in this product, are available to you at:

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http://super-dev/support/code/

Model Name: SSE-G2252, SSE-G2252P

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